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CHILD DEVELOPMENT



This number includes reports on artificial illumination of school rooms and flicker threshold; the development of motor coordination and speech; attitudes and quarrels among pre-school children; and on the influence of environment upon health.



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CHILD DEVELOPMENT

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Artificial Illumination for the Preschool Laboratory¹

RICHARD R. WHIPPLE, M.S.

ARTIFICIAL illumination in three rooms of the preschool laboratory of the Iowa Child Welfare Research Station was improved by relatively simple changes in design. The considerations which controlled the new design are given here in detail.

VISUAL REQUIREMENTS

Illumination design is determined primarily by the type of visual performance required of individuals in the space to be illuminated. The preschool rooms under consideration are used by the three-year-old group from 8:45 A.M. to 11:45 A.M. five days per week and by the four-year-old group from 1:00 P.M. to 4:30 P.M. five days per week. During the winter months, these hours include appreciable periods of very low-daylight intensity. The activities of the children include play with various mobile

toys and manipulation and construction with various kinds of blocks, easels and paints, clay, scissors, crayons and drawing paper, beads, etc. Dolls and miniature furniture, dishes, brooms, mops, and other household supplies are also available. The activities are such that an adult would perhaps be inclined to dismiss them as not requiring close visual attention or fine perception of detail. But the effect of immaturity must be considered.

The author remembers as one of his early painful experiences the first day he spent in school, after having been kept from school until the age of eight to avoid as far as possible the visual defects of both parents, neither of whom could read a newspaper without glasses. He could recognize all the letters if they were of very large size and could actually read, but the *First Reader* was absolutely baffling in spite of its relatively large type size. Due to lack of experience and practice, a page of this type was nothing but a blur, and it required two days of terrific effort to produce fine enough perception to be able to read. It was not a problem of learning to read but of learning a new visual process, and it was most disconcerting. The ultimate result of this late initiation into "fine" eye work is that the author can still

¹ The author has received every assistance in this project from Dr. George D. Stoddard, director of the Iowa Child Welfare Research Station, and the members of his staff. Curtis Lighting Inc. cooperated by suggesting the luminaire used. Mr. F. W. Kent, the university photographer, has produced the illustrations. Mrs. R. R. Whipple assisted in the making of illumination surveys and the preparation of the results.

pass the normal vision test with either eye. From this personal experience, two pertinent ideas may be established: First, even such visual work as appeals to an adult as very coarse may and perhaps often does seem exacting to a child when encountered for the first time. It is only necessary to watch a child at play to discover that tremendous concentration and effort are used on relatively simple



FIG. 1. INTENSE VISUAL EFFORT FOR A SIMPLE TASK

tasks (fig. 1). Secondly, there is an overwhelming weight of evidence to support the opinion that glare and eye fatigue in the early years are particularly effective in producing permanent damage to the eyes. For these reasons, it seems desirable to supply a preschool laboratory with the best possible illumination at all times.

General considerations

There are at least ten general factors to be considered in designing any in-

stallation for artificial illumination. They are discussed below with special reference to the preschool application.

Intensity. The intensity of illumination is controlled by the number and size of lamps used, reflection factors of walls and ceiling, type of fixture, etc. Almost any desired intensity may be secured. The range of intensity to which the human eye can adapt itself is very large, ranging from moonlight, which may be about 0.1 foot-candle, up to direct summer sunlight, which is in the neighborhood of 10,000 foot-candles. An attempt to read by moonlight or by direct sunlight will show that the most desirable range of intensity for close eye work is not at either end of this large spread. Present engineering standards of intensity range from three foot-candles for very coarse work through eight to ten foot-candles for schoolrooms, fifteen to twenty-five foot-candles for drafting or sewing, up to three hundred foot-candles for a hospital operating table. A preschool room probably fits in between eight and fifteen foot-candles, depending upon other factors to some extent.

Uniformity. Uniformity is concerned with the distribution of intensity over the floor or working area of a room and is usually expressed by the ratio of maximum to minimum intensity of illumination. Non-uniform illumination causes eye fatigue by requiring constant adaptation to different intensities as the eye wanders around the room. It is a simple muscular fatigue. Also, if the illumination is not fairly uniform, the provision of a given average intensity which sounds adequate will leave certain areas of the room poorly lighted.

Most school lighting codes require that the ratio of maximum to minimum intensity shall be less than four. If the value of the ratio is less than two, uniformity is remarkably good. These values seem large, but the eye reacts logarithmically to changes of intensity and a change of two to one is not very apparent.

Diffusion. Diffusion is best illustrated by the contrast between raw sunlight and the diffused skylight when the sun is behind clouds. Well diffused light strikes an object from all directions so that it is not necessary to hold it in any particularly plane to get proper lighting. Any obstruction between the source and object cuts off some light but not all of it, giving soft and luminous shadows as opposed to the sharply defined black shadows resulting from a concentrated source. Good diffusion contributes to "natural" appearance, convenience, and freedom from eyestrain.

Glare. Glare is the greatest damaging factor in artificial illumination due to the small sources of high brilliance. It is defined as any condition in the field of view which produces discomfort because of high brightness. Direct glare from lighting fixtures arises from the use of improper reflectors, from failure to use any reflector, or from mounting the units too low. Reflected glare is the result of using too small inclosing fixtures in connection with glossy surfaces, so that a direct reflection of the bright fixture is seen on the working plane. Glare of both kinds is at its minimum with indirect lighting by which the entire ceiling surface becomes the apparent light source. The source is at maximum

height and, due to its extent, is of the lowest possible brightness to produce a given intensity of illumination. The use of large inclosing bowls of dense white glass, mounted high, gives the least glare of all direct lighting systems. Desk and wall surfaces should always have a matte finish. The uninitiated often confuse glare with high intensity. If the illumination of a room seems too bright, it almost always means that there is too much glare rather than that the intensity is too high. Artificial illumination never approaches the daylight of outdoors even on a dull day.

Shadows. Shadows, while of importance in producing proper images of shape, will be satisfactorily controlled without additional effort if the ideas presented under "Diffusion" and "Glare" are followed.

Color quality. The color given by the usual tungsten filament incandescent lamp is fairly easy on human eyes and gives color values of sufficient accuracy except for such things as matching dyed fabrics, professional art work, etc. "Daylight" lamps should be avoided because of a 20 per cent loss in efficiency without any appreciable gain in visual performance. The light of these lamps is still far from daylight color. Indirect lighting systems use the ceiling surface as a reflector and the resulting illumination will be of a color dependent on the ceiling finish. Therefore, a ceiling for indirect lighting should be white, cream, light gray, or a very light tint of green or blue.

Efficiency. The efficiency of artificial illumination should be measured in terms of a certain ability to see

without eyestrain for a given cost in dollars per year of total expense. More conventionally, efficiency is expressed as the quantity of light falling on the working plane compared to the quantity of light emitted by the bare lamp. These definitions do not give the same results because it is to be expected that a system which controls the light adequately to give good diffusion and prevent glare will be less efficient than a simple reflector directing all the light downward to the working plane. But the less efficient, on this basis, may be the more desirable. By the conventional definition, indirect lighting is usually about thirty per cent less efficient than direct lighting, and yet it may easily produce the best vision available for a given expense. A lot of light on the floor is not the ultimate purpose of illumination. A modern tendency is toward the use of a great many small lamps. By shifting to indirect fixtures, proper control of large lamps may be provided and the inefficiency of the indirect system is more than compensated by the higher efficiency of the large lamps. One 200 watt lamp emits twice as much light as eight 25 watt lamps. Efficiency is relatively more important than cost of fixtures. A fixture is purchased only once, but its inefficiency exacts tribute on every monthly bill for energy. One of the fixtures purchased recently for this preschool for \$13.50 will consume \$250 worth of energy in the next ten years. One could afford to double the first cost if it would provide an efficiency 5 per cent higher.

Maintenance. Lighting fixtures, lamps, and all reflecting surfaces need

to be carefully cleaned at regular intervals, as efficiency drops rapidly with dust collection. Fixtures which are easily opened and cleaned should be chosen.

Aesthetic suitability. It is possible to make an efficient lighting fixture which has a pleasing appearance, either lighted or unlighted. For the preschool, a simple, neat appearance without much effort at decoration is desirable.

Cost. The subject of cost with respect to efficiency was discussed under "Efficiency." In general, the cost of good lighting is no greater than the cost of poor lighting. The social value of good illumination is tremendous as compared to the cost.

Specific considerations

In the preschool rooms under consideration, the artificial illumination is used a great deal. Daylight is not very good in two of the rooms, due to orientation of the building, location of neighboring structures, and small window area. The laboratory was formerly a residence, and there are relatively few outlets available, so that it is difficult to get proper coverage of the floor area (uniformity). This difficulty is increased by the fact that the ceilings are only nine and two-thirds feet high. These low ceilings make it difficult to avoid glare with any direct lighting system. The artificial lighting will undoubtedly be used more in the future because it is of higher intensity. It is natural to turn the lights on as daylight fails, but if the added artificial light does not seem to add much to the total, the lights are switched off until it gets darker.

Higher intensity lighting will be found to be comparable to daylight more hours of the day and hence will be used more.

THE OLD INSTALLATION

A description of the former installation and photometric measurements made under it are included here to indicate what poor illumination was accepted by an otherwise progressive preschool management. This descrip-

intensity was 0.8 foot-candle, insufficient for the simplest visual requirements. Direct glare was very bad, as is apparent from the photograph. There were multiple sharp shadows. Bare lamps do not provide satisfactory illumination under any circumstances.

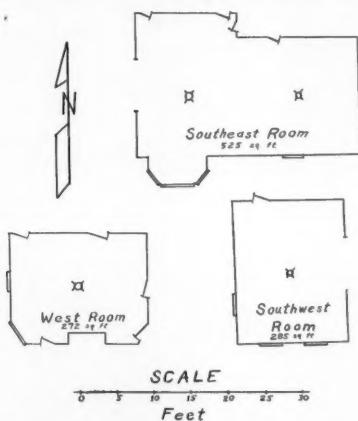
The southeast room, shown in figure 5, had two decorated white glass inclosing bowls, each with a 150 watt lamp. The general appearance of the lighted room was satisfactory, but the uniformity was poor, the ratio of maximum to minimum illumination being 6.8. The average illumination was 1.26 foot-candles, just barely sufficient for adult reading without immediate discomfort. Direct glare was not bad, but an increase of intensity by using larger lamps in the existing fixtures would have raised their brightness to a dangerous value. Shadows were reasonably good.

The southwest room (fig. 7) had one fixture of the same type as the southeast room; this fixture was equipped with a 100 watt lamp. General appearance was satisfactory. The uniformity was the best of any of the rooms (5.35), and the average intensity of 1.94 foot-candles was also the best of the three rooms. The installation was satisfactory from the standpoint of glare and shadows. Due to the expertise of the photographer, figures 3, 4, and 5 appear much better lighted than did the actual rooms.

FIG. 2. FLOOR PLANS OF THE THREE ROOMS

tion will also provide a basis for comparison with the new installation. The improvement made by rather simple and inexpensive changes is astonishing. Floor plans of the rooms are shown in figure 2.

The west room, as illustrated in figure 3, had a five branch hanging fixture equipped with bare 40 watt frosted lamps. The woodwork in the room was dark, and the appearance was very dingy. The uniformity was poor with a ratio of maximum to minimum illumination of 6.6. The average



The new installation

All three of these rooms were changed to totally indirect lighting, using an opaque bowl unit known as The Gem No. 5050 by Curtis Lighting, Inc. The original outlets were used in



FIG. 3. OLD LIGHTING IN THE WEST ROOM



FIG. 4. NEW ILLUMINATION IN THE WEST ROOM



FIG. 5. OLD LIGHTING IN THE SOUTHEAST ROOM



FIG. 6. NEW ILLUMINATION IN THE SOUTHEAST ROOM

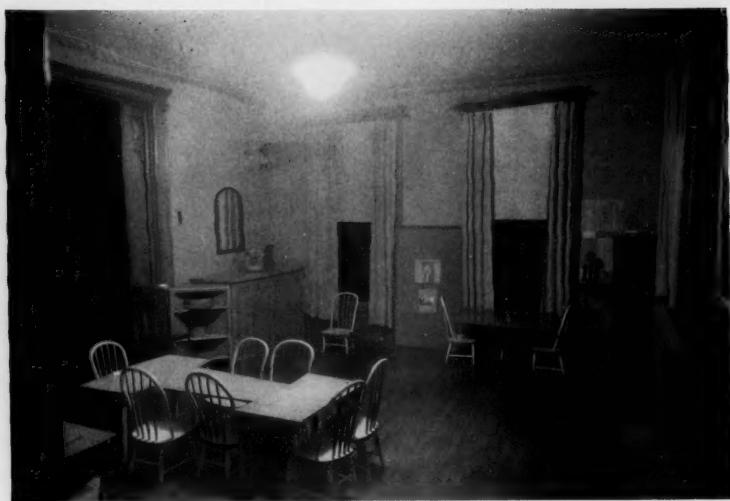


FIG. 7. OLD LIGHTING IN THE SOUTHWEST ROOM



FIG. 8. NEW ILLUMINATION IN THE SOUTHWEST ROOM

each room, so there was no wiring expense. The fixtures were hung as low as possible, leaving only six feet, two inches of clearance from the floor, in order to cover a large ceiling area to improve uniformity.

The new illumination in the west room is shown in figure 4. The fixture contains a 500 watt lamp. The ratio of maximum to minimum illumination is reduced to 4.4. This figure is scarcely low enough to be desirable, but the effect of poor uniformity is compensated by the high intensities used. The average illumination is 8.3 foot-candles and the minimum in usable parts of the room is 6 foot-candles. It would be impossible to improve the uniformity in this room without repainting the woodwork or using two outlets.

The southeast room, shown in figure 6, was supplied with two 500 watt lamps, which produced an average illumination of 6.5 foot-candles with a uniformity ratio of 3.3. This is very satisfactory.

The southwest room, shown in figure 8, has a 300 watt lamp and the artificial illumination is an average of 5.5 foot-candles with a uniformity ratio of 3.3. The designed intensity of this room is lower than for the others because it has the best daylight and is less used than the others.

It will be noticed that the ratio of maximum to minimum illumination in each case is approximately one-half of the former value. This improvement in uniformity is due entirely to

the change from direct to indirect lighting. The average intensity has been increased from threefold to tenfold simply by increasing the ratings of the lamps used. The new intensities do not fit the suggested values of eight to fifteen foot-candles because during the use of these rooms by preschool children there is always an appreciable daylight intensity to swell the total. The room with the poorest daylight has the most artificial light provided, etc. There is no glare of any kind in any of the rooms, and the shadows are soft and luminous. Vertical surfaces are as well illuminated as the horizontal working plane. All intensity measurements quoted were taken by the author with a Weston Illuminometer on a horizontal plane eighteen inches above the floor.

The rooms of the preschool laboratory now have a decided air of cheerfulness, even on a dull winter morning. One has the impression of stepping into sunshine on going indoors! The psychological effect of good lighting is of great importance. There is also a distinct educational value. Both children and visiting parents have an opportunity to see what good illumination looks like, and improvement at home may follow. Illumination of residences is far behind industrial and commercial lighting. Is it too much to hope that good illumination in the schools will produce, in the next generation, adults who will demand proper illumination of homes and work places?

REFERENCES

Interesting material on the subject of illumination for the nontechnical reader will be found in the following publications:

- (1) Committee on Residence Lighting of Illuminating Engineering Society: Artificial light and its application in the home. New York: McGraw-Hill, 1932. Pp. viii, 145.
- (2) HARRISON, WARD, AND STALEY, K. A.: Fundamentals of illumination. General Electric Co., Nela Park Engineering Dept., Cleveland, Ohio, 1931 (January), Bulletin L.D. 1-A, pp. 60.
- (3) HARRISON, WARD, AND WEITZ, C. E.: Illumination design data for industrial and commercial interiors. General Electric Co., Nela Park Engineering Dept., Incandescent Lamp Dept., Cleveland, Ohio, 1930 (January), Bulletin L.D.-6, pp. 36.

The Hurdle Jump As a Developmental And Diagnostic Test of Motor Coördination For Children From Three to Twelve Years of Age

EDWINA A. COWAN AND BERTHA M. PRATT

IN EXAMINING the motor coördination of children twelve years old and under at the Wichita Child Research Laboratory at Friends University, we felt the need of a test for motor coördination which would not involve any eye-hand coördination, which would be a true index of the child's capacity to make adequate motor adjustments to situations confronting him hour after hour in his play and home life, which would be practical for use in routine examinations in the laboratory, and which should lend itself to standardization. In experimenting with different devices to meet this need, we found that a standing jump over an adjustable hurdle met all these requirements most successfully.

The following is an account of work we have done during a period of four years toward standardization of this test and of the clinical results we have obtained with its use.

We make grateful acknowledgment to Mr. L. W. Mayberry, Superintendent of Wichita Public Schools; to the school principals, the school teachers, the students of Friends University and the coöperative mothers who by

their interest, encouragement and gracious expenditure of time have made this study possible. Lastly, we make our devoirs to the women of the Wichita Child Research Laboratory Board, through whose unstinted gifts of time and interest the benefit of psychological research and service is given to the children of Wichita.

DESCRIPTION OF APPARATUS

The apparatus used consisted of two hurdle posts and a bamboo stick; each hurdle post was built of an upright piece of wood two by two and fifty-four inches high; brackets on three sides formed the base. The unbracketed surface of each hurdle post faced the other hurdle post as they were placed side by side. Forty-one round metal pegs, a quarter of an inch in diameter and extending an inch and a half from the edge of the two by two were fitted into holes in each post. These holes were located one above the other on a line running along the center of the front side of the hurdle post as it stood with the unsupported side facing the other hurdle post. The center of the lowest peg was three and one-half inches from

the floor; the pegs were so spaced that there was an inch and a quarter from center to center of each peg. The hurdle pole consisted of a bamboo stick approximately three quarters of an inch in diameter and four feet long. This was used to extend from a peg on one hurdle post to a corresponding peg on the other hurdle post, forming a complete hurdle adjustable as to height.

Experimental procedure

The child was asked if he liked to jump and the posts and the bamboo stick brought forward and placed in position. They were placed about three feet from each other with the unsupported sides facing each other and all the pegs extending in the same direction. The pole rested on the two lowest pegs. The child was asked to stand about a foot or less from the pole half way between the posts and on the opposite side from the pegs; he was asked to make a standing jump over the pole with both feet at once. The direction of his jump was such that if he hit the pole, it would roll off the pegs and the child would not be tripped. If, in jumping, the child hit the pole or for any other reason failed to make the jump successfully he was given another trial with the pole at the same height. If he failed on the second attempt, he was not asked to jump higher. If he succeeded on the first or second attempt the pole was moved up one peg. Each time the child successfully accomplished the jump on the first or second trial, the pole was moved up one peg until two successive failures to clear the pole occurred at the same height. Sometimes, if we were examining a child who

was very timid about jumping, a child badly retarded in motor coördination or a child under three years of age, we placed the pole first upon the floor between the posts and allowed the child to make the slight jump necessary to get over the pole. If the child was successful in making this jump, the pole was then placed on the first peg. If the child did not understand the verbal instructions the experimenter made the jump to show him how. If he failed to keep his feet together in starting and finishing the first jump, he was reminded that he should try to keep both feet together. After this first reminder nothing more was said about the form of the jump. If the children were able to jump at all, they were uniformly interested and eager to see how high they could jump. A standing jump was always insisted upon. They were never allowed to make a running or a stepping approach to the hurdle.

There were two possible variables involved in scoring the jump: one, the height of the jump; the other, the form in which the jump was made. The height of the jump necessary to clear the pole varied according to which of the pegs the pole rested on. The pegs were numbered from one to twenty-three. Peg number one was nearest to the floor. These numbers were listed on the scoring sheet (see table 1) and a check made opposite each number when its corresponding peg was used during the test. The following variations of form in making the jump were possible: the jump might be made with both feet together on leaving the floor and regaining the floor; one or the other foot might be

ahead in either of these situations; the landing might be made upright; or the child might fall forward to his knees, or to his hands and knees. More rarely, he might fall backwards. He

one made with both feet leaving and regaining the floor together and ending in an upright landing. The presence or absence of fear was not included in the definition, although record was

TABLE 1
Hurdle

Name..... Date..... Age.....
Fear..... Grade..... Age Level.....

HEIGHT of pole	FEET LEFT FLOOR			FEET REGAINED FLOOR			LANDING MADE			
	Left ahead	Right ahead	Together	Left first	Right first	Together	Upright	Knees	All fours	Back- ward
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
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18										
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22										
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24										
25										

might attack the jump with confidence or timidity.

Arrangements were made on the scoring sheet (see table 1) for recording by checks in appropriate columns the exact form of each jump made during the test. For the sake of uniformity in handling of quantitative results, we defined a jump made in good form as

made of timidity, and the fact sometimes used in assisting diagnostic interpretation of individual records.

The highest jump which the child made in good form, as herein defined, was accepted as the limit of the child's achievement. Even though the child cleared the pole when set on a higher peg, if the two feet failed to leave the

floor together or to land simultaneously or if the landing was not made upright, this height of jump was discarded in the child's achievement record. Sometimes the acceptable form of the jump lapsed at one height but was regained at a higher jump level. The highest jump made in good form was always accepted, no matter how many preceding jumps had been made in unacceptable form.

The scoring sheet also made provision for recording the child's name and age in months and the date of the test.

We were interested in determining the value of this test as a diagnostic test for children twelve years and under. In standardization, therefore, we used, as subjects, children between the ages of thirty-six months and one hundred fifty-five months. To obtain the records for children between sixty and one hundred fifty-five months we made arrangements with the school authorities whereby we could give the test to children in the kindergarten and elementary buildings. The experimenter was given the use of a small room and the children were sent to her one at a time from the school room.

The records for the children under sixty months of age were obtained by visits to the Children's Home, a local institution for children whose parents are unable to maintain them in their own homes; to the homes of children whose names were obtained from the Cradle Rolls of churches; and to the three day nurseries conducted by The Family Welfare Association and the Junior League of Wichita. Additional records for all ages were obtained by making this test a part of the routine

examination given to children who were brought into the Wichita Child Research Laboratory for diagnosis and supervision of training problems. In taking records from the files of the Laboratory for use in standardization, we used only those of children who exhibited no difficulties with motor coördination in extro-laboratory situations and whose training problems did not involve motor coördination. No such basis for elimination was possible in connection with the children used outside of the Laboratory and they, therefore, represent an unselected group. Of a total of five hundred forty children examined, twenty-five were examined in the Laboratory.

The five hundred forty children comprising the experimental group were divided as follows among the age groups:

3 years (36-47 months).....	34
4 years (48-59 months).....	37
5 years (60-71 months).....	40
6 years (72-83 months).....	27
7 years (84-95 months).....	91
8 years (96-107 months).....	44
9 years (108-119 months).....	53
10 years (120-131 months).....	75
11 years (132-143 months).....	97
12 years (144-155 months).....	42

In the preliminary studies it was found that the test was not applicable to any children under three years, but that at 36 months a few children could jump at least one notch. Because of this we arbitrarily selected 36 months as the starting point for chronological age groups rather than the more usual 42 months. The original plan was to have 50 children of each age group included in the experimental group. Because twelve years was set as the

upper limit of the group, this would have made a total of five hundred. However, using a public school as the source of most of our records, we were not able to find fifty children for each of all the groups and some groups have

theoretically, we assumed the developmental nature of improvement in the ability to make this jump. Therefore we used Dr. Arnold Gesell's (1) technique in establishing developmental schedules for pre-school chil-

TABLE 2

NOTCH JUMPED	AGE (IN YEARS)									
	Number of children in age group									
	3	4	5	6	7	8	9	10	11	12
	per cent	per cent	per cent	per cent	per cent	per cent	per cent	per cent	per cent	per cent
1	68	90	95	96	97	100	100	100	100	100
2	59	90	95	96	97	100	100	100	100	100
3	38	84	92	96	97	100	100	100	100	100
4	32	70	90	93	90	100	98	100	99	100
5	29	51	88	89	90	98	96	100	99	100
6	19	35	83	89	85	93	94	100	99	100
7	6	21	80	78	82	89	94	99	99	100
8			68	67	77	86	94	97	99	100
9			45	52	68	84	92	96	99	100
10			35	44	59	75	85	96	98	100
11			20	41	45	63	81	95	96	100
12			10	29	28	48	77	89	95	100
13			5	11	11	34	66	79	84	100
14				9	4	27	51	68	80	95
15					1	16	34	58	71	90
16					1	14	23	30	56	81
17						5	15	17	41	59
18						5	2	8	31	40
19							6	23	29	
20									9	17
21									6	7
22										2
23										2

nearly four times as many as others. This irregularity in numbers apparently does not affect the reliability of the results as a whole, as these results show a high degree of consistency.

RESULTS

The first problem set was the establishing of a series of norms. Hypo-

dren as the technique best suited to this problem.

Table 2 presents the numerical figures in terms of cumulative per cent showing the height of jump made by children of the various ages.

Dr. Gesell's system of grading is as follows: 1-19 per cent, A+; 20 per cent-49 per cent, A; 50 per cent-64

per cent, B+; 65 per cent-84 per cent, B; 85 per cent-100 per cent, C.

Applying this system to our figures for height of jump for the chronological ages used, table 3 was developed.

The table is incomplete in the four-year-old group. Preliminary tests were made with very low hurdles having only seven notches, and when the tall

an "A+" rating was not obtained, but the 21 per cent is very close to such rating.

This table may be read as follows: a five-year-old child who makes a jump of seven notches has a grade of "B," which means that from 65 per cent to 84 per cent of the five-year-old children jumped as well as he did. If he had

TABLE 3

NOTCH JUMPED	AGE (IN YEARS)									
	3	4	5	6	7	8	9	10	11	12
1	B									
2	B+	C								
3	A	B	C							
4	A	B	C							
5	A	B+	C							
6	A+	A	B	C						
7	A+	A	B	B	C					
8		B	B	B	C					
9		A	B+	B	B	C				
10		A	A	B	B	C				
11		A	A	B+	B+	B	C	C		
12		A+	A	A	A	B	C	C		
13		A+	A+	A	A	B	B	B	C	
14			A+	A+	A	B+	B	B	C	
15				A+	A+	A	B+	B	C	
16					A+	A+	A	B+	B	
17						A+	A+	A	B+	
18						A+	A+	A	A	
19							A+	A	A	
20								A+	A+	
21									A+	
22									A+	
23									A+	

hurdles were used in the later tests the work was not repeated with the three- and four-year-olds, as so few of them had jumped even up to the seventh notch. However, in the four-year-old group, eight children did jump seven notches. This is 21 per cent and obtains only an "A" rating. This four-year-old group is the only one in which

jumped 13 notches, his grade would have been "A+," which would mean that only 19 per cent or less of the five-year-old children jumped that high. But an eleven-year-old child who jumps thirteen notches gets a grade of "B." A child who jumps as well as 85 per cent of the children of his age (appearing on the table as

the last "C" in each vertical column) may be regarded as having satisfactory motor coördination. A child who jumps higher or lower than this satisfactory jump may be compared either with children his own age or with children older or younger than he. For instance, a child of five who jumps twelve notches has a grade of "A+" within his own age group, or he is advanced developmentally to a level satisfactory for an eleven-year-old. On the other hand, a child of eleven who jumps seven notches is definitely retarded, since all eleven-year-olds should

TABLE 4

AGE	MEDIAN JUMP	GESELL "C"
3	2	0
4	5	2
5	8	5
6	9	6
7	10	7
8	11	8
9	14	10
10	15	12
11	16	12
12	17	15

be able to jump at least eleven notches, and his score of seven must be interpreted in terms of a satisfactory jump for a seven-year-old. This system gives flexibility and accuracy to the interpretation of a jump.

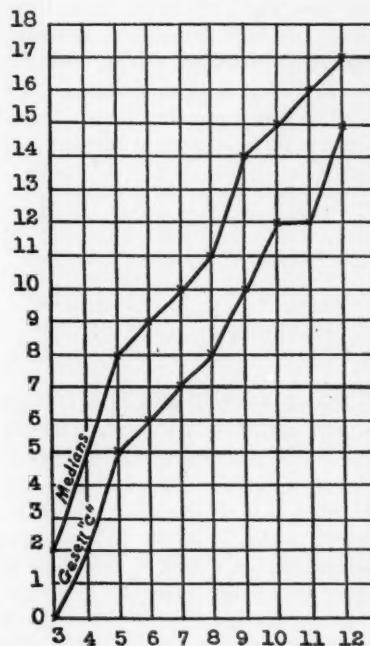
For purposes of comparison with these norms the median jump for each age was worked out. The following table gives the median jump and the jump at which the grade of "C" was assigned by the Gesell technique, for each age.

Throwing the figures of table 4 into graph form, the curves for medians and

for the Gesell "C" show very similar characteristics. Whether measured by the median or by the Gesell "C," the height of the jump increases with age in the same degree. See table 5.

There is a consistency in these results which suggests the validity of the jump as a developmental index of motor

TABLE 5



coördination. The older the child is the higher he jumps. There are, however, obviously other factors which may enter. The older the child is, the taller he is and the heavier. Should the efficiency of his ability to jump be measured in terms of his age or in terms of his height or weight or in terms of the relation of his height and weight

to his age? To further validate the developmental character of the jump, the correlation technique was applied to all results for children over five years. There was no way to obtain the heights and weights of the pre-school children as their records were obtained through so many sources and over such a long period of time.

If weight is the determining factor for the height of jump, then there should be a high correlation within each age group between weight and the jump, as age is held constant. The results, using the Pearson product-moment formula, were as follows:

5 years.....	$r = .27 \pm .10$
6 years.....	$r = .11 \pm .13$
7 years.....	$r = .00 \pm .07$
8 years.....	$r = .20 \pm .10$
9 years.....	$r = .22 \pm .09$
10 years.....	$r = .15 \pm .08$
11 years.....	$r = .07 \pm .07$
12 years.....	$r = .00 \pm .11$

The only correlations high enough to be regarded as possibly significant are in the five, eight and nine year groups. In view of the fact that the correlations in all the other groups are entirely insignificant we feel justified in believing the weight of the children not to be a determining factor for the height of jump.

In correlating the jump and height with each other within the age groups, we find the following:

5 years.....	$r = .39 \pm .08$
6 years.....	$r = .31 \pm .12$
7 years.....	$r = .16 \pm .07$
8 years.....	$r = .00 \pm .10$
9 years.....	$r = .35 \pm .08$
10 years.....	$r = .13 \pm .07$
11 years.....	$r = .24 \pm .07$
12 years.....	$r = .30 \pm .09$

Here we find higher coefficients than in the correlation of the jump and weight, but they are not high enough for it to be maintained that height alone can be the determining factor for the height of jump. It may be that if a child is tall for his age he will make a slightly better jump than a child of the same age who is short.

Although weight and height alone apparently have little significance for the height of jump, it is possible that their relation to each other and to age might have some effect on the child's ability to jump. For instance, does a short, fat child of eight jump more poorly than a tall, slim child of eight? To answer this question statistically, the relation between height and weight must be expressed in terms comparable for all ages. Our first step toward this expression was to obtain from a pediatrician a standard chart of heights and weights for children of all ages. From this chart an index which we chose to call the "corporosity index" (C. I.), or the expression of the relation of height to weight, was calculated for each age and for boys and girls separately by dividing weight by height. Next, the "C. I." was calculated for each child. This done, the deviation from the normal "C. I." for each child's age, and the deviation from the median jump for his age was found. If these two deviations were to show a high correlation with each other within the age groups, then it might be assumed that this relation, as expressed here, could be significant in determining height of jump. Using the Pearson product-moment formula, except in the case of the six-year-old group, where the Spearman rank dif-

ference formula was used, we have the following results:

5 years.....	$r = -.008$
6 years.....	$r = .22^*$
7 years.....	$r = .08$
8 years.....	$r = .05$
9 years.....	$r = .01$
10 years.....	$r = -.03$
11 years.....	$r = .05$
12 years.....	$r = .04$

* Spearman rank difference formula.

All of these results are so insignificant that we may state with little hesitancy that the relation of height to weight has no significance in determining the height of jump.

As a final check, since there are four variables involved, the technique of partial correlation was applied to the entire group, the principal objective being to find the correlation between the jump and age with height and weight ruled out. The raw correlation between these two was found to be .77; with the factors of height and weight ruled out, .57. Weight alone had nothing to do with the height of jump. However, the figures indicated that a possible slight significance might attach to height of the child. This is probably enough to account for the lowering of the coefficient between jump and age. Another possible reason for the lowering of this coefficient may be sought in the figures for raw correlation of jump with height and weight. The raw correlation between jump and height was $r = .67$, and that between jump and weight was $r = .61$. Although these correlations are made for the entire group regardless of age, they are higher than one would expect and on that account may explain somewhat the lowering of

the coefficient between jump and age. This does not make less accurate the statement that the jump, standardized in terms of chronological age, may be used as a definite, quantitative measure of motor coördination.

Clinical use of the test

In the course of developing experimental technique for this test, and for a period since the standardized norms have been available, we have used the test in connection with clinical work in the Wichita Child Research Laboratory and have found it of diagnostic value in three ways:

First, it makes possible a quantitative grading of defective motor coördination in cases of birth injury, infantile paralysis, and other organic defects of the nervous system. The fact is clearly observable that children who have suffered birth injury are retarded in their motor coördination, and are crippled in their attempts to handle their bodies as other children do. No matter how obvious this crippling may be, it is often desirable to measure it in quantitative terms which offer a basis for comparison between individuals and between performances of the same individual at different times.

Second, in a number of instances the test has uncovered for us slight retardations in motor coördination which were affecting the personality and social adjustments of children. The cause of the difficulty had not been clear to the parents because the children's ability to walk and get about had not been noticeably affected. In such cases parents uniformly commented as follows: "We knew she did not run and play active games with the

other children; but we thought it was because she did not like to, was lazy, or did not want to play with other children in this active way." One child had been severely reprimanded in kindergarten because she did not join in the skipping games. The history of her year in kindergarten was described as completely lacking in co-operative effort and social adjustment to the group. The child, who was seven years old at the time, showed marked personality and social difficulties due to her inability to participate in the group play of other children, and was already embarked upon a career of school failure. The test showed that the child was unable to skip or play the running, active games of other children, although she did not even show awkwardness in walking. Other parents reported that their children had always been awkward and stumbled a great deal. They had attributed this to carelessness and inattention because the child seemed able to get about in a satisfactory manner. These children were inevitably shy and timid, lacking the self-confidence engendered by the achievement of adequately controlled motion on the part of a child whose coördination level is normal. If a child cannot depend upon his two feet to carry him safely and comfortably across a room and up and down steps, and to maintain a steady balance in the face of slight spacial discrepancies, surely this child cannot be expected to develop any genuine self-confidence at a very rapid rate. In some cases acute personality problems of adolescents could be traced to an ever-increasing sense of insecurity due to failure of the

initial source of self-confidence, which had been denied them because of retarded motor coördination. In our experiments, children with marked congenital visual defects invariably showed retarded motor coördination and equally marked insecurity of personality.

Third, the test offers a quantitative measure of progress during a motor reëducation program. The motor reëducation technique used in the Wichita Child Research Laboratory is not that which is known as muscle-training in the orthopedic centers. The training differs from muscle-training in that it does not attempt to develop a compensatory use of the muscles themselves. The hypothesis underlying our program assumes that in cases where coördinations have failed to appear, which usually do appear as part of the organism's normal maturation process, the adaptive chain of muscular contractions and kinesthesia which constitutes such motor coördinations can in many cases be set up as a learned activity.

If this assumption is correct, any process by which the desired coördination can be artificially and correctly produced should ultimately result in the acquisition of the coördination as a learned activity. Our motor education technique has consisted of attempts to produce the acquisition of these learned coördinations in a series which should as nearly as possible approximate the normal developmental series, beginning with the earliest type of grasping motion in the case of the hands, and rhythmic rotation of the feet and knees in case of the legs.

Because we have hoped to produce

a chain of muscular contractions which would be automatized with kinesthesia as the only sensory stimulus, we have blind-folded the children during the periods of artificially produced coördination, except in the case of infants of less than twelve months of age. In the case of the infants we felt that the visual environment was not yet operative as an important source of sensory cues for muscular contractions.

Obviously the best form and order in which to present the artificially produced coördinations is still a problem of research. Available information as to the order of appearance of different maturation levels of the same muscular activity and analyses of complex activities into their component maturation elements are lacking in completeness. In formulating a program we added to the facts at our command continually by means of observations and analyses of observable progress made by children undergoing motor reëducation. These children were constantly under the care of orthopedic specialists and our observations of progress were always carefully checked with their reports. Through this process of feeling our way along the maturation path we arrived at a series of training exercises which we feel roughly approximates successive levels of complexity in motor coördination as achieved by children who make these adjustments under normal circumstances. Because of the importance we attach to the developmental phase of the reëducation process there is very little variation with reference to individual diagnosis in the programs carried on. Each child is

started at the beginning of the program no matter what the degree of disability, the only variation being between cases whose disability is general and those for whom it is specifically confined to hand or foot coördination. The following paragraphs describe this motor reëducation program as it has been developed to date:

With the child lying on his back on the floor, we place his hands in normal grasping posture on a slender pole. The trainer insures this grasping posture by holding his own hands over those of the child. The trainer then lifts the child up and down so that the weight is supported by the hands which are artificially forced to maintain a supporting grasp. As soon as progress permits, this exercise is followed by games such as tug of war, chinning, etc., with a soft, strong rope. Next in the series comes the dropping of a small ball and a one inch wooden cube from one hand into the other. Increased facility in this type of handling objects is followed by the working out of block patterns through touch and the lifting of blocks into pattern positions previously ascertained by touch from a model. Blindfold handling and identification of variously shaped and textured objects is encouraged when the child is old enough. The winding and unwinding of a string around a spike fastened in a block of wood is usually introduced at about this point in the training program. The string is wound clock-wise and anti-clock-wise with each hand. This has been found especially helpful in facilitating the coördinations used in hand-writing by older children. From this point on the program for hand coördination be-

comes one of individual adaptation to the age, needs, and progress of the child.

The foot coördination for very young babies is started by laying the infant on his back, placing a hand flat against the sole of each foot, holding the ankles in place with the fingers and rhythmically rotating the feet in a pedalling motion. In the case of children who are able to stand or walk, the training is begun by placing them in front of a flight of steps, blindfolding them, and letting them step upon one step, turn around, and step down. The blindfold is then removed. When the child has achieved facility in this, another step is added and care is taken that the motion involving the two steps shall be a normal alternation of the feet. This is done even if it involves external support of the child and placement of his feet on the steps by the trainer. Steps are gradually added one at a time. When normal progress up and down steps is possible without support, the child is equipped with a bicycle held in a training frame so that it is perfectly steady. The training frame is one which permits the pedals and rear wheel to revolve, while the bicycle remains stationary. The bicycle is carefully fitted to the child in such a way that when the pedal is at its lowest point of revolution, the child's foot rests horizontally on the pedal and the leg is straight from hip to ankle. The child is placed upon the bicycle and then blindfolded. If the child is unable to revolve the pedals, they are revolved for him while his feet are held upon them. After four or five revolutions the blindfold is removed and the child is lifted off. If the child can make the pedals re-

volve, he is allowed to do so for five or six revolutions and then the blindfold removed and the child taken off the bicycle. As the child becomes more accustomed to the pedalling motion, he is allowed to pedal for a longer period of time, but never for more than five minutes at a time.

After some measure of progress has been made with stair-climbing and pedalling and the child has achieved the rhythmic pedalling or stepping motion, he is taught to stand on one foot and move the other in a vertical, circular motion similar to the pawing of a horse. Following this he is taught to skip and do various kinds of rhythmic marching and stepping motions to music.

The entire training program for both hand and foot coördination is carried out with the child blindfolded whenever he is going through any of these activities. Before the training program is embarked upon, the child is accustomed to blindfolding by games and very short periods of having his eyes closed or covered with his hands or the putting on and immediate removal of a bandage. Candy or sections of orange are used to condition the child to the blindfolding with a liking response. No training activity is undertaken until the child is perfectly comfortable and happy wearing a blindfold bandage. Great care is also maintained to be sure that the child does not fall or have any unpleasant or frightening physical experience during any of these activities. The program is never allowed to become a disciplinary issue. The whole activity is associated with pleasure and assurance in the child's mind.

Nothing that is done in the way of

TABLE 6
Boys' records in capital letters; girls' records in small letters

NOTCH NUMBER	AGE (IN YEARS)											
	3			4			5			6		
	16 boys	18 girls	17 boys	20 girls	20 boys	20 girls	13 boys	14 girls	13 boys	14 girls	13 boys	14 girls
1	B+	b	B	c	C	C	C	C	C	C	C	C
2	B+	b+	B	c	C	c	B	c	B	b	C	b
3	B+	a	B+	b	C	c	c	B	b	C	b	c
4	B+	a	A	a	C	c	B	b	B+	B	b	b
5	A	a	A	a	B	c	B	b	B+	B	b	c
6	A	a	A	a	B	b	B	b	B+	B	b	c
7	A+	a+	A	a	B	b	B+	b+	B	b	C	b
8					A	a	A	a	B	b	C	b
9					A	a	A	a	B	b	C	b
10					A	a	A	a	B	b	C	b
11					A	a	A	a	B	b	C	b
12					A+	a+	A	a	B+	s	B+	a
13					A+	a+	A+	a+	A+	a	B+	a
14					A+	a+	A+	a+	A+	a	B+	a
15					A+	a+	A+	a+	A+	a	B+	a
16					A+	a+	A+	a+	A+	a	B+	a
17					A+	a+	A+	a+	A+	a	B+	a
18					A+	a+	A+	a+	A+	a	B+	a
19					A+	a+	A+	a+	A+	a	B+	a
20					A+	a+	A+	a+	A+	a	B+	a
21					A+	a+	A+	a+	A+	a	B+	a
22					A+	a+	A+	a+	A+	a	B+	a
23					A+	a+	A+	a+	A+	a	B+	a

exercise is planned or intended to strengthen any muscle or group of muscles. The objective of everything done is the acquisition of adaptive motor coördinations as learned activities. For that reason the learning technique is strictly adhered to. The exercise periods are arranged to give frequent, brief learning periods without any prolonged practice periods. The children are not allowed to repeat any given exercise more than twice in any practice period and the pedalling exercise is held rigidly to a period not longer than five minutes. The different exercises may be combined in one practice group period. Whenever the daily program of the child permits, he is given one practice period in the morning as soon as he gets out of bed, another the last thing at night before he gets into bed, one in the middle of the day, one in the middle of the forenoon and one in the middle of the afternoon. New exercises are added to the practice group when justified by the child's progress.

It will be observed that in this motor reëducation program as outlined there is no part which involves direct practice in jumping, with the exception of skipping, which is introduced toward the last of the program. We have used the hurdle jump test as a quantitative measure of progress in connection with such training programs, and have found the progress of the child from one age norm to another reliably indicative of the general progress of the child's ability to make adaptive motor coördinations, as reported by the mother and as observed in visits to the laboratory. For example, the fact that a child for the first

time is able to make a jump in good form over the pole at the first notch will coincide with the statement on the part of the mother that she has noticed in the child's play and routine activity at home much less stumbling and much greater self-assurance.

The motor coördinations acquired in the course of training programs as outlined are indicated as true learned activities by the fact that they show a tendency to lapse or be forgotten in some degree after the training program is discontinued even though the program has been maintained until adequate adaptive coördinations have been successfully acquired. The hurdle jump test reflects this forgetting process with quantitative accuracy and also reflects the rapid restoration of efficiency during a renewal period of the training program. We have not had any cases under observation long enough yet to know whether these acquired motor coördinations can eventually be well enough established to justify permanent discontinuance of training periods. We use the hurdle test to guide us in regulating the periodic resumption and the duration of renewed training periods.

Sex differences. Table 6 shows a comparison of performances of boys and girls in the hurdle jump test. The records for boys are indicated by capital letters, and the records for girls are indicated by small letters. See table 6.

A study of this table will show that there is very little difference in performance between girls and boys of the same age. What difference there is seems to be consistently in favor of the girls up to the age of seven years.

Starting with seven-year-olds, the boys have a slight advantage through the age of twelve.

However, we do not feel that we had sufficient numbers in these different age groups to have established definitely even this small sex difference. In view of the slight amount of difference and of the small number of subjects in some of the groups when divided according to sex, we do not feel justified in advising the use of separate developmental tables for boys and for girls.

SUMMARY

(1) The results of hurdle jumping experiments with children aged three to twelve years inclusive can be graded progressively in chronological age groups according to Dr. Gesell's system of developmental grading.

(2) The median jump for the age groups increases with chronological age.

(3) The curves for the median jumps and the Gesell C are similar.

(4) Weight is not a factor in determining the height of the jump.

(5) While height of stature may be a factor in determining height of jump, it is so slight as to be negligible compared with age.

(6) The relation of height to weight is not a factor in determining height of jump.

(7) Chronological age is a definite factor in determining height of jump.

(8) The form and height of a standing hurdle jump may be measured with sufficient exactitude to provide a quantitative test of gross motor coördination correlated closely with chronological age and applicable to children of ages three to twelve years inclusive.

(9) The statistical findings and the configuration of the results treated according to Dr. Gesell's system of grading indicate that maturation is a determining factor influencing the height of jump and that the test as used is a true developmental test of motor coördination.

(10) The test is clinically of diagnostic value in affording a quantitative measure of retardation of motor coördination; in uncovering minor retardations of motor coördination; and as a quantitative measure of progress during programs of motor reëducation.

(11) There is some indication of slight differences between the sexes in favor of the girls below the age of seven, and in favor of the boys of seven years and above. The evidence on this point is inconclusive.

REFERENCE

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A Comparison of the Flicker Thresholds In Children and Adults

GEORGE W. HARTMANN¹

THIS study originated in an attempt to test a suggestion of Koffka's (1) that if the hypothesis of the generally high fatigability of the motor nervous systems of young organisms be correct, then presumably on the sensory side the threshold of fusion for rotating discs should be lower for children than for adults. Koffka considers it probable that the resulting greater susceptibility to visual fatigue should lead to the more rapid extinction of flicker in youngsters, since they would be unable to follow the last faint traces of internal differentiation which precede the appearance of a uniform and homogeneous field. Since the problem lends itself readily to a straightforward experimental check, the following simple laboratory situation was arranged.

The apparatus consisted of a D. C. motor with a slide-wire resistance for regulating the speed. An engineering tachometer was coupled to the shaft of the motor and permitted reading directly the number of revolutions made per minute (R. P. M.) at any given instant. All extraneous illumination was excluded from the room, the only light coming from a 100 watt

Mazda blue "daylight" lamp suspended from the ceiling but directed upon the color mixer. Only two pairs of cardboard discs were mounted upon the rotator; one black-and-white combination (180° of each) and the other blue-and-yellow, also in equal proportions. Laboratory experience had seemed to indicate that these pairs yielded the smoothest and most satisfactory fusion; at any rate, the phenomena in question could be most readily followed by the subjects when these sets were employed.

In the first group of trials, the records of a dozen normal children were compared with those of adult "controls." Only persons with 20-20 vision who passed a color-blindness test were used. The confidence of the children was gained by a timely distribution of candy and by encouraging them to inspect some of the curios of a psychological laboratory. The nature of the task was carefully and patiently explained to the youngsters; two subjects were eliminated after the preliminary demonstration series because of evident suggestibility and unreliability. All observations took place at a distance of four feet from the rotator. The subjects were asked to watch the flicker at the edge of the disc and to look directly at that area. Although few persons normally take

¹ The writer is indebted to his graduate students, Messrs. Swanson and Gettig, for assistance in securing subjects and personal help during the testing sessions.

advantage of the higher sensitivity of the peripheral retina, precautions were taken against this possibility by ad-

The extinction limens were determined in conventional psychophysical fashion, i.e., by taking the mean of

TABLE 1

Comparison of the thresholds of fusion for young children and adults in terms of revolutions per minute

OBSERVERS	SEX	AGE	180° BLACK + 180° WHITE	180° BLUE + 180° YELLOW
Children				
A	Female	7	2,700	2,880
B	Female	11	2,350	2,260
C	Female	8	3,370	2,650
D	Female	9	2,930	3,120
E	Female	10	3,760	3,440
F	Male	8	3,320	2,880
G	Male	8	3,370	2,950
H	Male	8	2,440	2,675
I	Male	7	2,960	3,110
J	Male	6	3,760	2,722
K	Male	9	3,200	3,075
Means.....			3,105	2,887
A.D.'s.....			(394.54)	(229.91)
Adults				
L	Male	22	3,110
M	Male	20	2,760
N	Male	20	3,200
O	Male	19	2,900	2,680
P	Male	19	2,950	2,650
Q	Male	18	2,790	3,110
R	Male	18	2,900	2,610
S	Male	19	2,700	2,555
T	Male	25	2,700
U	Male	21	3,600	2,810
V	Male	25	3,200	2,515
W	Male	24	2,940	2,740
Means.....			2,979	2,709
A.D.'s.....			(198.83)	(133.50)
Difference in favor of children.....			126	178

justing the observer's chair so that his eyes were in a straight line with the mixer.

three ascending readings and three descending ones. If anyone of the readings deviated markedly from the

trend established by the remaining values, it was thrown out and an extra record made. In all instances, the

that the adult limens are definitely lower than the children's thresholds. This means that the presence of flicker

TABLE 2

Comparison of the thresholds of fusion for younger and older males in terms of revolutions per minute

OBSERVERS	AGE	180° BLACK + 180° WHITE	180° BLUE + 180° YELLOW
Children			
I	7	2,892	2,760
II	7	3,265	3,320
III	6	2,782	2,645
IV	8	2,982	2,832
V	6	3,480	3,345
VI	6	2,978	2,840
VII	10	2,665	2,430
VIII	8	3,686	3,114
IX	9	3,110	2,670
X	8	2,850	3,076
Means.....		3,069	2,903
A.D.'s.....		(253.00)	(248.40)

Adults

XI	21	3,140	3,110
XII	25	2,985	2,740
XIII	22	3,070	3,086
XIV	20	3,057	3,674
XV	19	2,668	2,566
XVI	22	3,282	3,002
XVII	20	3,464	3,110
XVIII	23	2,696	2,562
XIX	25	3,250	3,134
XX	23	2,842	2,930
Means.....		3,045	2,891
A.D.'s.....		(198.20)	(205.00)
Differences in favor of children ..		24	12

black-white determinations preceded the blue-yellow ones. Table 1 shows the results thus secured.

From these figures it is apparent

TABLE 3

Comparison of the thresholds of fusion for younger and older females in terms of revolutions per minute

OBSERVERS	AGE	180° BLACK + 180° WHITE	180° BLUE + 180° YELLOW
Children			
I	8	2,588	2,538
II	7	2,562	2,545
III	7	2,507	2,448
IV	6	2,553	2,674
V	7	2,571	2,543
VI	7	2,541	2,552
VII	7	2,538	2,517
VIII	7	2,526	2,547
IX	7	2,755	2,671
X	6	2,840	2,752
Means.....		2,598	2,578
A.D.'s.....		(81.30)	(71.90)
Adults			
XI	22	2,533	2,516
XII	21	2,599	2,569
XIII	25	2,537	2,449
XIV	23	2,635	2,522
XV	19	2,633	2,526
XVI	24	2,578	2,526
XVII	23	2,581	2,528
XVIII	21	2,619	2,627
XIX	22	2,559	2,581
XX	22	2,627	2,527
Means.....		2,590	2,540
A.D.'s.....		(32.50)	(34.30)
Difference in favor of children ..		8	38

can be detected by the youngster at speed levels where it has ceased to exist for the adult. The "error of variable standard" seemed at first blush to be

responsible for these differences, since one could argue that the children may have waited until the flicker was definitely gone (in the case of the ascending method) before reporting extinction. The slower reaction-time of the youngsters would thus produce the effect of a higher mean threshold. However, this tendency (if real) would also operate with the descending procedure and serve to produce lower readings, thus cancelling the former effect. Consequently, this explanation may be rejected.

It may be argued that these children, whose average age was about eight years, are actually adults from the standpoint of sensory functioning, and that a fair test of Koffka's hypothesis would require the use of younger subjects. Unfortunately, this proved to be an impracticable suggestion, for an attempt to use a few bright nursery-school children collapsed entirely because of their high distractibility and the excessive irregularity of their "judgments." A child must evidently be of at least school age before he can be of service in this type of experimentation.

The heterogeneity of the child group with respect to sex raises a more legitimate difficulty. The five girls yield a mean black-white limen of 3022 R.P.M.; the corresponding figure for blue-yellow is 2870. For the six boys the black-white average is 3175 and the blue-yellow 2902—in both instances, the boys' means exceed the girls' by about the same amount that children's averages combined rise above those of the adults. This suggested the necessity for keeping the subjects constant in regard to sex. In

the next series therefore, ten other boys with a mean age of $7\frac{1}{2}$ were compared with a new set of ten male undergraduates. These results appear in table 2. The precision of these values is somewhat greater than those given above since five ascending and five descending determinations were now made instead of the three previously required.

On this occasion, the differences in the extinction thresholds for the two groups are considerably less pronounced, but the children maintain the higher averages with both stimulus-pairs. Certainly no support for Koffka's view can be found in these two tables—in fact, the direct opposite appears to be a more plausible position. A further check was made involving ten little girls and ten college women, the adults being tested first. The children were second grade school children of more than average brightness. The discs used in this series were of somewhat different shade than that previously employed, but the comparison between the adults and the youngsters is not affected thereby. Table 3 presents these findings.

Here again complete confirmation is given to the results of the first two tables. The extinction thresholds of the older and younger subjects are essentially identical, with but a small margin in favor of the children on both sets of discs.

These figures point to but one conclusion: The measured behavior of children of primary school age and young adults reveals substantially the same performance, with respect to the rates of revolution at which flicker

ceases to be detected. Evidently the fundamental mechanisms involved in this type of visual discrimination achieve maturity relatively early in life.

SUMMARY

Thirty young school children and thirty adults were measured in standard psychophysical fashion with re-

spect to the rotary velocity required to extinguish flicker effects produced by (1) black and white discs and (2) yellow and blue discs, combined in equal proportions. No significant differences between the thresholds for the two age groups were found.

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Children's Drawings: An Experimental Study of Perception

E. B. HURLOCK AND J. L. THOMSON¹

DRAWING, as a means of expressing what one perceives, is commonly used in the free, spontaneous drawings of children. The purpose of the experiment to be reported below was to discover what young children perceive with sufficient consciousness to portray at a later time, when the object is not present, in their spontaneous drawings of eight specified objects.

Much theoretical and experimental work has been done in an attempt to study children's drawings. Those studies which have any relationship to the study reported in this paper are summarized below. In summarizing the studies, it seemed best to use the historical sequence method, beginning with the work of Barnes (4) in 1893, and coming down to the present time.

HISTORICAL SURVEY

The drawings of 6,393 children, ranging in age from six to sixteen years, in their free illustration of the poem, "Johnny Look in the Air," were recorded and analyzed by Barnes (4). From the data obtained, Barnes made

¹ The senior author suggested and outlined the problem reported in this paper, supervised its progress and prepared the manuscript for publication; the junior author carried out the experiment and presented it as a Master's Essay at Columbia University.

many deductions, the most important of which are as follows:

1. For the young child, drawing is a language, a means of expressing ideas, in which symbols and conventional forms are used.
2. The courage to express their ideas through pictures increases to the age of 13 or 14 years.
3. Children like to draw large, distinct figures, expressed with few lines.
4. Children are interested in heads. Up to nine years of age, they draw full faces, then profiles.
5. For decorative effects, they use colors; for drawing pictures, they prefer black and white.
6. Typically, the child's drawing is full of movement.
7. There is little difference between the drawings of boys and girls.

One year later, in 1894, Herrick (16) made a similar study of the drawings of 451 children, illustrating the same poem as that used by Barnes (4). He found that boys and girls followed the same lines of interest and development, although boys expressed themselves a trifle more fully. The tendency to draw profiles instead of full face occurred in 9.5 per cent of the drawings of the 5-6-year level; in 55.5 per cent of the 10-year level; and in 68.7 per cent of the 14-year level.

"What children draw to please themselves" was studied by Maitland (22) in the case of children ranging in

age from five to seventeen years. Up to the age of ten, it was found that attempts to draw the human form predominated; objects of still life showed a predominance at all ages; houses, animals and plants were drawn less frequently in the older than in the younger age levels; and, interest in geometric design and ornament increased with age.

As a means of determining the best method of teaching drawing, Lukens (21) made a study of the drawings of children from 2 to 16 years of age. Three-quarters of all the drawings studied were of human figures. The best drawings showed a tendency to draw long, firm, continuous lines.

Biographical records and observational notes of individual children's drawings were made by Millicent Shinn, Katherine W. Slack, Eleanor G. Sharp and Lulu M. Chapman. These were edited by Brown (6) in 1897 in the University of California Studies, and covered the age period of eighteen months to six years. Slack noted that after the age of 5 years 6 months, "Ruth" began to draw houses, churches and boats, and that she took more pleasure in color than in form. According to Sharp, "Bayard" began to draw horses at 2 years of age. At 3, he copied objects and found subjects more interesting than color. "Carroll," Chapman reported, always showed an interest in color, and any new feature included in his drawings was exaggerated.

In the study of her niece, Shinn observed the following stages of development in drawing: 1. Drawing as imitation of another's act; 2. The first pictorial was the result of accidental

resemblance in scribbling; 3. Up to 4 years of age, forms of beauty were less interesting than objects; 4. There was a tendency to generalize, especially detail, and to conventionalize; 5. Form proved to be more interesting than color.

Gallagher (quoted by Hart (15)) made an analysis of the spontaneous drawings of children from five to fifteen years of age. She noted that the tendency to draw people increased to the sixth year, then declined; drawing of trees and horses increased to the seventh year, then declined; conventional designs increased from the seventh to the twelfth year, then declined. And, drawings of birds, animals, plants, engines, cars, tools and stores rose and fell erratically. Small children use size for emphasis, and they draw what interests them.

What type of drawing children from six to twelve years of age will make to illustrate a hymn referring to God, stars, clouds and angels, was studied by Hart (15). There was found to be a steady increase in the drawing of stars, sky and clouds with an increase in chronological age, and a steady decrease in the number of drawings which depicted God, angels and the earth.

Burk (8) in a study of the "Genetic versus the Logical Order in Drawing," found three periods of development which are; first, a period of wholly muscular movements, unguided by visual centers in any degree, which occurs in the second and third years; second, the beginning of crude representation, which slowly proceeds toward interest in accurate drawing of objects as really seen. This period, from the fourth to the ninth or tenth

year, is characterized by the fact that the visual centers show evidence of inability to control the delicate muscles of the arm, hand and fingers; third, the beginning of interest in the accurate representation of what the eye sees and the exclusion of associated ideas. The child has practically no interest in conventional designs and in abstract, geometrical forms, since drawing is a language for the expression of his ideas.

In 1913, Thorndike (31) devised a scale to rate the child's achievement in drawing. Drawings of children from eight to fifteen years of age were collected and their value in degrees of merit was judged numerically, as established by a majority of judgments. The purpose of this scale was to provide an objective measure for marking drawings.

Baldwin (3) and Waddle (32), in brief discussions of children's drawings, have attempted to show that they develop in a manner similar to the art of primitive man. The drawings, according to them, begin with meaningless lines and progress through a stage in which lines have meanings, a stage where decorations predominate, and finally, a stage of picture writing. All of these stages are an outgrowth of self-expression which results in an increasing capacity for appreciation and enjoyment.

Stern (30) has expressed a similar idea in stating that children's drawings are merely efforts to "mark down their ideas of things; that pleasure in drawing is more universal in the first than in the latter years of life, for children scribble away gayly, and are not troubled by the inadequacy of their representations. For this reason, el-

ders must not look at children's drawings from an aesthetic point of view, but rejoice that their perceptual life finds in them new and unrestrained expression." According to Kirkpatrick (27), the child, in the early stages of drawing, considers his drawing a success if he knows what the lines stand for. Later, he judges it to be successful if his lines are so made and related that others know what he means.

McCarty (23), in a study of 31,239 spontaneous drawings, gathered from sections representing all parts of the United States, and made by children ranging in age from four years to eight years eleven months, found results similar to those of Maitland (22). Interest in the human form, fruits, vegetables and insects decreases with age, while interest in buildings, wild-birds, sun, moon, stars, trees, flowers, geographical conceptions and composition increase with age. Toys reach a high point of interest in the fifth years; toys and vehicles in the sixth and seventh years. No real differences between the drawing interests of boys and girls was found to exist.

As a means of establishing the relationship between children's drawings and their intelligence, Goodenough (12, 13, 14) analyzed 1,000 drawings made by children from kindergarten through the first four school grades. The object drawn was the human form and the drawings were analyzed to establish a norm for each age and class level. She found that the order of development in drawing is remarkably constant, even among children of very different social antecedents, and that

there is a close relationship between concept development, as shown in drawing, and general intelligence. On the basis of these findings, she developed a "drawing test" as a means of measuring the intelligence of young children.

Luguet (19, 20) has indicated that children's drawing passes through four stages, which are as follows: (1) Involuntary drawing, in which the child, at first, does not know that his lines can represent something; (2) The child tries to synthesize the details of his drawings for the exclusive purpose of representing each one for its own sake; (3) The child synthesizes his details and includes the details of the objects he sees. This is the period of "intellectual realism"; (4) The period of "visual realism," in which particular attention is given to perspective.

Bühler (7) has concluded that children's drawings pass through six stages of development which are as follows: 1. Preliminary scribbling, which leads through accidental resemblance to a representative function; 2. Drawing from memory, "out of his head;" 3. Portraying objects with their constant and essential attributes only; 4. Drawing to give a "graphic account," in which errors in spatial relationships and errors in translation of knowledge are to be expected; 5. Drawing synthetically, consisting of addition of part after part; and, 6. Realistic drawing.

Experimental procedure

The experiment reported in the following pages was carried out by the junior writer. Every child in the kindergarten, first and second grades

of four schools was given a piece of paper, 6 x 9 inches, and was asked to draw a picture of a man, any kind of man he wished to make. No time limit was set and the children were permitted to use pencils, crayons or both, according to their individual wishes. After this drawing was finished, the children were asked to draw in turn seven other objects; a girl, a house, a dog, a tree, a flower, an automobile and a boat. These objects were chosen not only because they were assumed to be familiar to every child and thus could be drawn from memory, but also because in many previously reported studies, they were found to be among the child's chief drawing interests.

The schools used in this experiment have, as a part of the daily routine, some time set aside every school day for drawing, but no drawing is taught before the second grade and, even then, at least 80 per cent of the children's drawings are free and imaginative. With the exception, therefore, of the drawings done by the children between 7½ and 8½ years of age, those included in this experiment were practically free from the influence of any formal teaching.

The younger the children, the less time was needed to produce the eight drawings asked for. The children of the kindergarten ages finished in an hour and clamored for more drawing opportunities. The first grade children needed an hour and a half and the second graders, two hours or more. There was a marked difference between the older and younger children in the amount of confidence and discrimination shown in their drawings. Kinder-

garten children cheerfully and confidently drew any object and were usually satisfied with their results. The first graders were willing to attempt anything, but were often critical of their results. The second graders, on the other hand, were often skeptical of their abilities even before beginning to draw and made discriminating remarks about the finished products.

Subjects. As the object of this experiment was to discover what children perceive at four different age levels, the grouping of the children was made on that basis, rather than upon their school grades. No children were younger than 4½ years, and none were older than 8 years and 5 months. They were grouped as follows:

Level I. Children from 4 yrs. 6 mos. to 5 yrs. 5 mos.

Level II. Children from 5 yrs. 6 mos. to 6 yrs. 5 mos.

Level III. Children from 6 yrs. 6 mos. to 7 yrs. 5 mos.

Level IV. Children from 7 yrs. 6 mos. to 8 yrs. 5 mos.

These levels including numbers, sex, and intelligence quotients are given in table 1.

The children of each age level were classified according to Terman's five intelligence groups, as follows:

Dull.....	80- 89
Dull normal.....	90-109
Superior.....	110-119
Very superior.....	120-139
Near genius.....	140-

Levels I and II included all five groups; Levels III and IV only the first four.

RESULTS

In classifying the 2,292 drawings made by the children used in this study, all drawings for each of the intelligence level groups were analyzed under the headings of "General," "Specific," "Background," "Association of Ideas," "Color" and "Design." In addition to these common factors, each object was analyzed according to its individual details, the smallest number appearing in the drawing of flowers, and the largest in those of a man and a girl. The number of times each thing included in the analyses appeared in a given group, was noted, and given in terms of percentage, as will be seen in the following tables. The crudest effort to draw any detail was counted. Objects were considered "general," unless specific qualities were evident; any picture featuring sky, grass, water or horizon line was credited with "background;" any additional details as, a kennel for a dog, or a dock for a boat were called "associated ideas;" color was counted as correct except in such absurd cases as a man with green hair, or a dog with a blue tail; and design was credited to any picture which definitely showed a nicety of balance in color or form. This was included because the writers constantly noted that children added a balancing detail to those pictures which seemed one-sided. There was no evidence of attempts at formal design except in the dresses of the little girls, or in the gardens, which was often the form chosen for flower drawing.

Tables 2 to 9 gives a complete analysis of the details of the different draw-

ings made by the children. The results are presented in terms of the I. Q. levels within each age level, no

TABLE 1
Classification of subjects

I. Q. RANGE	AGE LEVELS												TOTAL	
	4 years 6 months to 5 years 5 months			5 years 6 months to 6 years 5 months			6 years 6 months to 7 years 5 months			7 years 6 months to 8 years 5 months				
	Boys	Girls	Total											
80- 89	1	0	1	2	0	2	2	0	2	3	1	4	9	
90-109	14	10	24	23	18	41	20	18	38	13	13	26	129	
110-119	4	9	13	17	16	33	13	16	29	9	3	12	87	
120-139	8	7	15	7	7	14	8	8	16	5	5	10	55	
140-	0	3	3	0	1	1	0	0	0	0	0	0	4	
Totals...	27	29	56	49	42	91	43	42	85	30	22	52	284	

TABLE 2
Analysis of details of drawings of a man
(In terms of percentage of appearance in each age level)

	GENERAL	SPECIFIC	HEAD	HAIR	HAT	FEATURES	EARS	THUMBS	BUTTONS	ARMS	FINGERS, 5-	FINGERS, 5+	LEGS	FEET	SHOES	STOCKINGS	BACKGROUND	ASSOCIATION OF IDEAS	COLOR	DESIGN
Level I.....	100	100	15	19	56	12	68	27	65	11	19	72	51	6	1	33	14	41	17	
Level II.....	99	1100	31	29	81	54	89	32	78	86	6	2	77	88	55	27	22	29	31	4
Level III.....	87	13100	40	70	100	20	99	35	95	15	12	2100	76	55	30	62	25	100	21	
Level IV.....	81	19100	27	68	100	23	100	20	97	6	8	6100	95	88	41	56	40	97	26	

TABLE 3
Analysis of details of drawings of a girl
(In terms of percentage of appearance in each age level)

	GENERAL	SPECIFIC	HEAD	HAIR	HAT	FEATURES	EARS	THUMBS	BUTTONS	ARMS	FINGERS, 5-	FINGERS, 5+	LEGS	FEET	SHOES	STOCKINGS	BACKGROUND	ASSOCIATION OF IDEAS	COLOR	DESIGN
Level I.....	100	100	20	6	70	15	90	27	55	18	9	92	58	8	5	31	17	7	2	
Level II.....	100	100	64	10	98	2	88	16	62	27	5	99	87	52	16	17	7	74	25	
Level III.....	98	2100	54	15	100	6100	10	65	15	2	1	100	71	49	42	55	23	97	8	
Level IV.....	95	5100	65	30	100	9100	8	84	17	14	99	99	82	78	58	30	100	36		

percentage of appearance in each age level. Because of the relatively small

attempt was made to analyze the results in terms of the I. Q. scores.

These tables show that the tendency to perceive the specific, rather than the general, in familiar objects, increases

(Brown, 6) who wrote that her niece drew objects of a general type before attempting the specific. Barnes (4),

TABLE 4
Analysis of details of drawings of a house
(In terms of percentage of appearance in each age level)

	GENERAL	SPECIFIC	CHIMNEY (PERPENDICULAR)	CHIMNEY (SLANTING TO LEFT)	CHIMNEY (AT RIGHT ANGLES ON LEFT)	CURTAINS	POREHES	STEPS	BACKGROUND	ASSOCIATION OF IDEAS	COLOR	DESIGN
Level I.....	100		15	4	8	18	2	9	35	8	59	9
Level II.....	98	2	29	10	36	44	15	4	57	37	89	45
Level III.....	98	2	39	2	38	44	16	14	73	23	100	47
Level IV.....	97	3	39	4	28	67	9	23	87	51	100	67

TABLE 5
Analysis of details of drawings of a dog
(In terms of percentage of appearance in each age level)

	GENERAL	SPECIFIC	HEAD	EARS	TAIL	LEGS 2	LEGS 4	ORGANS	COLLAR	BACKGROUND	ASSOCIATION OF IDEAS	COLOR	DESIGN
Level I.....	100		96	16	68	79	18	9		32	24	37	12
Level II.....	91	9	100	56	67	39	57	1	24	41	29	70	1
Level III.....	83	17	100	61	84	60	41	1	10	63	20	87	5
Level IV.....	69	31	100	84	100	38	63	2	11	74	28	100	23

TABLE 6
Analysis of details of drawings of a tree
(In terms of percentage of appearance in each age level)

	GEN- ERAL	SPEC- IFIC	MASS	BRANCHES	LEAVES	FRUIT	BACK- GROUND	ASSOCIA- TION OF IDEAS	COLOR	DESIGN
Level I.....	89	11	47	54	37	11	31	20	59	12
Level II.....	96	4	31	79	40	4	48	32	86	8
Level III.....	97	3	49	51	19	3	65	18	85	24
Level IV.....	89	11	43	59	16	3	83	6	100	38

steadily with age. This is true in each of the eight objects drawn, and is in keeping with the findings of Shinn

Baldwin (3), Waddle (32), Stern (30) and Bühler (7) noted the tendency to draw lines which stood for simple

essentials, then symbols standing for objects, before truly representative drawing occurred.

have included an evaluation of background. As the children of this experiment have been allowed to use

TABLE 7
Analysis of details of drawings of a flower
(In terms of percentage of appearance in each age level)

	GENERAL	SPECIFIC	PETALS	LEAVES	BACK-GROUND	ASSOCIA-TION OF IDEAS	COLOR	DESIGN
Level I.....	100		29	31	48	8	32	33
Level II.....	89	11	38	83	64	25	70	12
Level III.....	94	6	49	86	65	14	71	37
Level IV.....	48	52	86	83	83	7	100	43

TABLE 8
Analysis of details of drawings of an automobile
(In terms of percentage of appearance in each age level)

	GENERAL	SPECIFIC	DOORS	WINDOWS	STEERING WHEEL	GUARDS	LIGHTS	HOODLINES	HOOD CAP	BUMPER	BACKGROUND	ASSOCIA-TION OF IDEAS	COLOR	DESIGN
Level I.....	98	2	41	45	22	7	15	31	6	1	18	11	100	7
Level II.....	99	1	39	42	12	16	3	48	27	25	42	41	100	8
Level III.....	94	6	50	60	27	21	14	66	35	14	84	20	100	14
Level IV.....	74	26	53	87	35	54	19	83	48	39	64	32	100	21

TABLE 9
Analysis of details of drawings of a boat
(In terms of percentage of appearance in each age level)

	GENERAL	SPECIFIC	STEIN	BOW	OARS	SAILS	FUNNELS	PORT HOLES	BACKGROUND	ASSOCIA-TION OF IDEAS	COLOR	DESIGN
Level I.....	99	1	10	10	2	4	30	29	62	9	57	29
Level II.....	93	7	35	35	1	43	24	30	70	36	80	27
Level III.....	62	38	39	39	1	28	48	67	81	20	100	28
Level IV.....	52	48	46	46	13	27	47	38	98	27	100	31

The tendency to perceive background and color placement increases with age, and, to a lesser degree with intelligence. As far as the writers know, no studies of children's drawings

drawing, freely, as a means of self-expression, the fact that they so frequently include it seems significant. Three times in 32 age level groupings, the average percentage of background

is less than 30; nine times it is more than 30; fourteen times it is more than 50; and six times it is more than 80. The amount of freedom allowed these children in their drawing has made it possible for them to draw from their "own consciousness of things" (Lukens, 21), and to "mark down their ideas of things" (Stern, 30). Our tables give substantial evidence that their consciousness and ideas of things are according to the laws of perception as stated by Koffka (18), *viz.*, that perception is an inclusive experience, and that a figure cannot be perceived without color, or darkness or light, spatial relationships, position and direction.

Color was always present, as the children used crayons in every drawing, but in the tables, color is only marked if used appropriately. The children of the youngest age level used color for the pleasure such colors offered them, "naturally," (Barnes, 4) and "with interest" (Chapman, quoted by Brown, 6). Its appropriate use, by the children of the second level increased 65 per cent over that of the first level, and each level above increased to some degree.

The tendency to perceive associated objects and design also increases with age, but no relationship is shown between this increase and intelligence. Exceptions are noted on Level IV, in the case of objects associated with a tree and a flower; exceptions in the increase of design occurred on Level III with the drawing of a girl, and on Level II with the drawing of a tree. The observations of the writer during the experiment, and those of several teachers during any drawing periods,

suggest a very close relationship between association of ideas and design. The association of ideas appeared to grow from the children's desire for a balance of form or color, rather than from a wish for associated objects. For instance, a child would draw a man and hold it up for the teacher or writer to see. If the drawing had not been placed in the center of the paper, and it seldom had, he would seize a crayon of any color, and add some associated object which nicely balanced the 6 x 9 paper. The nature of the addition seemed to depend upon the color of the crayon. If it happened to be orange, he would add a sun; if green, a cluster of flower stems, and perhaps colored tops would follow. One boy drew a dog, attached to a leash, held by a willowy, uncertain looking man. He offered his drawing to the writer, then withdrew it, saying, "I'll put a cane in the man's other hand—that'll hold him up." Apparently the man had been drawn to balance the dog, which had been placed below the center of the paper.

There is little evidence of interest in formal design, which is in keeping with the studies made by Shinn (Brown, 6), Maitland (22) and Burk (8), all of whom stated that conventional design made little appeal to young children; seldom younger than 11 years, according to Maitland. The few attempts at conventional design noted in the present experiment, were in the drawings of little girls' dresses, Indian wigwams (the result of an Indian project), and in flowers and gardens.

The interpretation of the details of specific objects is difficult, as, with the

exception of the man and the girl, the variety included differs. Generally speaking, the number and accuracy of details perceived increase with age and with intelligence. Attention will be called to one *detail* drawn in each of every object, excepting the man and girl, in which all details will be discussed. And the different placement of chimneys will be used as examples of increased accuracy. Beginning with Level I, the average of the I. Q. percentages of window curtains in the drawing of houses on each age level are 18, 44, 44 and 67, respectively. Percentages in the drawing of dogs' ears are 16, 56, 61 and 84; of branches on a tree 54, 79, 51 and 59; of petals on a flower 29, 38, 49 and 86; of hood lines on an automobile 31, 48, 66 and 83; and of boats showing bows and sterns 10, 35, 39 and 46. In the drawings of the man and the girl, the percentages showing hair, hats, features, arms and stockings always increase with age level, and, with one exception, this is true in the drawing of trunks, legs and shoes. The percentages of ears and feet drawn fluctuate, and of buttons and fingers, decrease with age. The accurate placing of chimneys on gabled roofs, increases with age more constantly than with intelligence. (All roofs were gabled; all placing was correct except in such cases as chimneys slanting to right.)

The tendency for the perception of details to increase with age is as would be expected from studies made by O'Shea (26), Burk (8), Judd and Cowling (17), McCarty (23), Goodenough (14), and Bühler (7). The tendency for certain details to decrease with age is probably due to the fact that a child

can only give his attention to a limited number of things at a time, and buttons and fingers certainly play a relatively more important part in the life of a four year old, than of a six year old child. O'Shea (26) says that children's experience with things causes them to draw any combination of their characteristics. Another reason may be due to a child's increasing appreciation of relative size, as stated by Chapman (Brown, 6) and Gallagher (Hart, 15). Some of the older children in this experiment criticized the drawing of fingers because they were "too large for the picture." And the tendency to conceal the fingers by drawing the hands in pockets, or holding something, or as doubled up in fists, increased with age. Also, there was an increasing tendency to cover the ears with hair or hats.

During the experiment the writers noted that the older children showed less pleasure in drawing the human form than in any of the other objects. In each group ranging from 6½ to 7½ years, at least five children had to be urged to draw a man or a girl, and the number doubled in the 7½ to 8½ year group. One of the latter refused, saying he couldn't draw a man that looked like one. So the writer suggested that he draw a picture of any kind, and put a man in it. Fifteen minutes later, he presented her with a picture of a beautifully arched bridge, from which a man was fishing. His shins and feet were hidden by the bridge, and his body and face well concealed by an overcoat and soft hat! The general decrease in confidence attending the increase of age and discrimination, is in keeping with the

findings of Clark (9), Burk (8) and Bühler (7). The writers could find no evidence that there was less *interest* among older than among younger children, as stated by Clark (9), Gallagher (Hart, 15) and Lukens (21). Human forms were frequently added to the pictures of the six other objects in this experiment, but the older children showed much less *satisfaction* in the human forms drawn, than they did in houses, automobiles and boats.

SUMMARY

The following statements offer a summary of the findings of this experiment:

1. The tendency to perceive the specific rather than the general increases with age.
2. The tendency to perceive background and color placement increases with age, and to a lesser degree, with intelligence. But the perception of both background and color is present to some degree on each age level.
3. The tendency to perceive associated objects and design increases with age, but shows little relationship to intelligence. Of the two, design,

when considered in terms of balance, seems the stronger tendency.

4. The tendency to perceive details increases with age and with intelligence.

5. The accuracy of perceptions increases with age, and to a lesser degree, with intelligence.

6. As perceptions become more discriminating on higher age levels, confidence in the ability to draw decreases.

7. The ability to give *artistic* expression through drawing shows little relationship to age or intelligence.

8. Between the ages of $4\frac{1}{2}$ and $8\frac{1}{2}$ years, inclusively, the ability for accurate and detailed perception, shows a more constant relationship to chronological age than to intelligence.

9. That further collections of drawings made by children who have been allowed to draw freely, as a means of self-expression, would offer valuable material for psychological study. The persistent tendency to perceive background, is in keeping with Koffka's statements of the laws of perception, in his introduction to the theory of *Gestalt Psychology*.

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An Analysis of Two Hundred Quarrels of Preschool Children

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DESPITE the modern interest in child development and in personality, maladjustment and social behavior, quarreling, a common type of child behavior has received little or no attention. Occasionally there is some discussion of quarrels in the literature on child training, in observational notes, and in child biographies. Sometimes quarrelsomeness appears as an item in rating scales for personality traits. What systematic treatment there is, is to be found mainly in the literature on anger, or incidental to studies of personality or social behavior.

The character of the studies made is indicated in the following review. With some types of investigation as summarized by Goodenough (14), we need not concern ourselves: for example, the theoretical literature on the nature of emotions, the physiological and neurological studies of anger, increased irascibility in certain mental and nervous diseases, racial differences in irascibility, etc.

Questionnaire studies. In a ques-

tionnaire study Hall (16) in 1899 made one of the earliest attempts to present a systematic account of anger. He attempted an analysis of factors which arouse anger, factors which increase irritability, and of characteristic age and sex differences in physical manifestations. Very young children, he said, vent their anger with no reference to the adversary; screaming and crying were the most characteristic vocal responses. More recently Gates (13) found from records of anger experiences of college women that the mean number of episodes for the week was 2.85; the modal duration was from ten to twenty minutes; 51 per cent of the episodes were followed by unfavorable after-reactions of some kind. A similar study by Richardson (22) on college men suggested that anger occurred somewhat more frequently among the male subjects.

The data for a more recent and comprehensive study of anger by Goodenough (14) were obtained from record blanks kept over a period of a month by the mothers of 45 children. A total of 1878 anger outbursts were analyzed for: sex and age differences in motor and vocal behavior during anger; types of reaction classified as "undirected energy," "resistant," or "retaliative"; frequency and duration of outbursts; factors contributing to

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increased irritability; activities during which anger occurs; causes of anger; number of outbursts and their relation to such factors as health, number of adults in the home, time of day; and methods of control and their effectiveness. Goodenough found that problems of social adjustment constituted the most frequent single source of anger outbursts among children. They made up 28.1 per cent of the entire number reported for the group.

Studies of personality traits. In certain studies of personality characteristics we find some phases of aggressiveness, or quarrelsomeness and their relation to other factors studied. Stratton (24) obtained a correlation of $-.102 \pm .016$ between emotion scores and academic grades of college students, indicating that success in scholarly work is more probable the less the individual is inclined to anger. Allport (1) made personality graphs for 55 college students from data which included questions on anger experiences. A study by Goodenough and Leahy (15), the "Effect of Certain Family Relationships upon the Development of Personality" considered certain aspects of quarrelsomeness. Levy (17), studying the resistant behavior of 983 infants and children during psychological testing, found age differences in patterns of behavior. Olson (20) found a negative correlation existed at all ages between general intelligence and problem tendencies in school children.

Rating scales and inventories. Scales such as the Marston Introversion-Extraversion scale (18), the Woodworth-Matthews Personal Data Sheet, and a

scale used at the Merrill-Palmer school contain items referring to the subject's social behavior. The behavior inventory designed by Andrus (2) covers a wide range of behavior items many of which refer definitely to our problem; for instance, strike in self-defense when attacked, let others take toys without protest.

Studies of social behavior. Phases of activity which are related to quarreling have been studied in a manner more similar to the present investigation as a result of the newer emphasis on social behavior. One of the earliest studies of this type by Verry (26) included coöperating with the group as one of the five types of social attitudes among pre-school children which she described. Studies by Thomas (25) and her associates at Teachers' College have revealed individual differences in types of response to social contacts, classified as passivity, coöperation, resistance, and flight. Parten's investigation (21) represented a systematic approach to the study of social behavior. The emphasis, however, is more on whether or not the child joined a group and what rôle he played in it, rather than on the actual adjustments and relations between the children in that group. Challman (11) aimed by a systematic approach to determine what factors operated in determining the friendship of young children. Bott's observation (5) of play activities in a nursery school included "relations with other children" as one category in the types of behavior recorded.

Studies devoted almost solely to quarreling. Using the data procured from a questionnaire issued by Hall in 1885

Burk (9) presented a study on teasing and bullying. His analysis, largely descriptive, treated such aspects as: the various forms of teasing and bullying, and the type of reaction in the victim. He found that boys exceeded girls in the number of tormentors. The source of data for Bovet's (6) "The Fighting Instinct," was 500 school-boy compositions on "When Children Fight, Why Do They Fight. Tell the Story of a Fight You Have Seen." Bovet listed various stages in a fight and described their order of appearance; the causes of quarrels he assigned to an instinct. Because of the theoretical views and the inadequate treatment of the data, the results of the study are of little value to us, but it is mentioned because it is one of the few investigations to deal solely with quarreling.

Experimental studies. Lastly, there are a few experimental studies which investigate the relations between two children in a situation so arranged that conflict easily and almost necessarily, arises. One of the first was made by Bühler (8) upon 114 nursing children. They were placed in a room by pairs, given various toys and their reactions in adjusting to the situation were recorded. By the end of the first year definite individual differences in response had appeared.

Using a similar, but more objective and controlled method, Walker (27) investigated domination and subordination in social interaction among nursery school children. An unseen observer recorded the behavior every five seconds during a six minute period in specified categories; for example, screamed, pleaded, relinquished pas-

sively. Consistent differences appeared in the behavior of each child. Mengert (19) made a similar study on ten two-year old children. One point was given for each instance of friendly or unfriendly behavior in the minute in which it occurred; and a final friendliness score was computed. She too found considerable consistency in the behavior of individual children.

Summary. In summary, the studies that deal with quarreling systematically are few in number. For the most part the subject has been treated more or less incidentally under various other topics. Thus, the questionnaire studies on anger listed some situations which were social in nature and which might have provoked quarreling (although the majority of these questionnaires were given to adults only). Rating scales and personal data inventories, studies of personality characteristics, of behavior problems and studies of social behavior also investigated various phases of adjustment, some recording quarreling quite directly, others more or less casually. Finally, there were studies devoted solely to quarreling such as the older questionnaire studies on teasing and bullying and on fighting among school boys. And more recently, there have been experimental investigations of the reactions of young children when paired in conflict-arousing situations. Very few of these, however, have attempted an analysis of the quarrel situation itself.

METHOD

Purpose. The present investigation aims to study and analyze the quarrels of preschool children as they

arise spontaneously in a relatively uncontrolled social environment. The morning free-play period was chosen for observation because then teacher-control is at a minimum.

Place and time. The study was carried out at the nursery school of the Institute of Child Welfare, University of Minnesota, during the fall and winter of 1931 and 1932. The data are based on 200 quarrels recorded during the period from October 19th to February 17th.

Subjects. The subjects were 40 nursery school children, 19 girls, 21 boys, ranging in age from twenty-five months to sixty months, with a median age of 43.5 months. The median age of the boys was 38 months, of the girls 44 months. Their IQ's ranged from 90 to 131 with a median of 106. These children are selected to be a representative sampling of the distribution of occupations in Minneapolis, grouped according to the Minnesota occupational rating scale. Actually the distribution is skewed since children whose parents belong in the lowest occupational groups, which shift from one locality to another, are difficult to obtain.

Procedure. An observational technique, the behavior sampling method was employed. To keep conditions as constant as possible the children were observed during the morning free-play period, which lasts approximately from 9:15 to 10:30.

In order to view the group as a whole, the observer watched the children from some central spot on the playground or from the doorway between the two main playrooms. When a quarrel developed the observer

moved quickly to the scene of action as unobtrusively as possible. Since all the children were quite accustomed to the presence of a number of observers—all armed with stop watches, notebooks and the paraphernalia necessary to research—it is not felt that the children were at all influenced by this record taking.

The procedure was to start the stop watch immediately upon noting evidences of a struggle, and to stop it when the issue was settled or when the teacher interfered. The observer did no recording during this time but devoted her whole attention to the quarrel. Immediately after, the record blank was completely filled out before continuing the observations, even if this meant missing some other quarrel. As the quarrels were of very short duration it is felt that errors of memory were thus reduced to a minimum. Running notes descriptive of the quarrel were taken as well, for they provide details that the categories do not give and are particularly valuable when one refers to the record at a later date.

Obviously the number of quarrels is an underestimate, for some were necessarily omitted or not noticed. This happened, of course, when one occurred while the observer was filling out a record blank, when more than one occurred at the same time, or when the observer noticed the quarrel too late to record the cause. In any cases in which the cause was ambiguous the record was not used.

Explanation of categories. Mimeographed blanks prepared in advance provided space for recording and checking the name and sex of the

children, the duration of the quarrel, what the children were doing and what difficulty arose, the types of behavior under proper categories (to be described), the motor and vocal activity, the outcome of the quarrel, and the after effects. The items on the record blank were derived partly from the questionnaire forms used in Goodenough's study "Anger in Young Children" (14).

Since the difficulties over which the quarrels started were almost as numerous in kind as the total number of quarrels some classification had to be made. Four categories were decided upon: possessions, physical violence, interference with activity, and social adjustment. The first type included, for instance, quarrels originating over a child's desire for another's doll, or a child's refusal to give up a swing. Difficulties were classified as physical violence when started, for example, by one child's slapping another, or throwing snow or sand. Interference with activity would be illustrated by one child's refusing to move his sled from the slide or by barring a child's way on the walking board. Examples of difficulties over social adjustment would be: "I don't want you to play in my house," or "Only girls can slide here."

The categories under *type of behavior* were used to describe the activity of the child during the quarrel. They were defined as follows:

Non-participant was a child who was in a group in which a quarrel occurred but who took no part in the quarrel.

The *precipitator* was the individual who caused the quarrel in the sense

that he started it; for example, Stephen snatched Faith's doll; or, Samuel wanted to get in the rocking boat so he tried to stop it in spite of the objections of those already in it. The precipitator did not always nor necessarily take the aggressive part in the quarrel; thus, Wanda precipitated a quarrel by knocking over a block in the "house." The other children took the aggressive rôle in attacking her.

Under *aggressive behavior* was recorded the name of the child who took the more aggressive part in the quarrel; for example, Walter (precipitator) snatched Marjorie's dish; she (objecting) said "That's mine;" Walter (aggressor) hit her and she immediately gave up the dish. When it was difficult to tell who was the more aggressive of the quarrelers the category "aggressive" was left blank. This was done in 36 of the 200 quarrels. As an instance, Lois threw sand on Cora. Cora pushed Lois and the quarrel was over.

Retaliative behavior implied attacking in response to attack. Thus, David who objected to Walter's shutting the door in his face, pushed and struck him; Walter pushed in return and threatened to throw snow at David as they struggled.

In *objecting behavior* the child resisted or objected to the action of the other child, or children, but did not go so far as to retaliate. Thus, he might have said "no" or "stop," but there was no directed attack upon the offender.

Undirected energy involved crying and screaming, jumping up and down, or stamping, without any directed resistance. It was also unverbalized; if

the child said "no" or "don't," for example, his behavior was classified as objecting.

No observable response to attack, and no vocalization was classified as *passive behavior*. To illustrate, Lois sat down in Wilma's chair. Wilma said "get out," pushed and pulled Lois out of the chair; Lois left without resistance.

Occasionally the type of behavior changed during the course of the quarrel, perhaps from objecting to retaliation. In this event the more directed form of attack, thus retaliation was checked.

Under *activity* the various forms of motor and vocal behavior displayed during the quarrel were checked for each child. Whenever possible, conversation was recorded. Under "forbid" were included such remarks as "don't," "no," "stop"; under "command" were included "get out," "go away," etc.

Cheerful was checked for the child who resumed his play after a quarrel apparently happy, without showing signs of ill-will or annoyance. A child was recorded as *resentful* if he scolded, whined, complained to the other children or to the teacher, or seemed in any way upset by the quarrel.

Entries were made after *child yielded* and *issue yielded voluntarily* to indicate more clearly the conditions of the yielding. The former means that the child yielded to force on the part of another child; and a further note was made to indicate to whom the child was forced to yield and the type of his reactions before yielding. Thus "Faith Y to F Wanda; obj." means that Faith yielded to force on the part

of Wanda after objecting. The category *issue yielded voluntarily* was made to cover those instances in which no child was forced to yield, but where the aggressor apparently abandoned the issue over which the quarrel arose; that is, the one who seemed to be winning gave in to the loser. To illustrate, Simon took Sue's dish. She cried and stamped and Simon gave the dish back.

In occasional instances the quarrelers *compromised*. For example, Bruce and Alfred were playing with the trains; Alfred pulled the train apart, whereupon Bruce hit him. Alfred in turn struck Bruce and then the two joined efforts in putting the train together again.

Unsettled quarrels were those which the teacher (on rare occasions another child) interrupted.

Reliability. To test the consistency on the record-taking, a second observer made independent records of ten of the quarrels. There were two instances of disagreement in classifying the type of difficulty, and two in classifying the issue because of the second observer's misinterpretation of a category. There was disagreement in recording the type of behavior for one child, and the after effects for two children. The author's greater practice in record taking enabled her to make more complete records of motor and vocal activity. Except for these items the records of the two observers were identical.

The rank order correlation for individual frequency of quarreling between the first 100 and second 100 quarrels is $.63 \pm .07$. Applying the Spearman-Brown prophecy formula this becomes .77. The rank order correlation for the

individual frequency of quarreling for the 200 quarrels, determined by the odd-even method is $.83 \pm .03$. This is raised to .91 by the Spearman-Brown formula. See table 3.

Since the character of the data renders it difficult to calculate a simple numerical score for the consistency of the other results, the author computed separately the results for the first 100 and for the second 100 and for the total 200 quarrels. In treating the first 100 and second 100 quarrels separately we are, in effect, applying the basic concept of reliability; that is, we are virtually repeating the experiment. The results for the two halves showed marked similarities; hence, for the sake of brevity the author is presenting here only the figures for the total 200 quarrels.

Sources of error in method. As mentioned before the number of quarrels recorded is an underestimate of the total number that occurred and this may have resulted in unequal emphasis on those of certain children. Again, since only the overt after-effects are noticeable, possible cases of concealed resentment would have been unobserved. More adequate treatment of the child who is drawn into a quarrel when he happens to be near the scene of action would be desirable.

The consistency of the second observer's records with those of the author would seem to indicate that errors from misinterpretation are confined mainly to the type of difficulty and to the issue; a more objective method of classification would be of value here. Although the number of cases when divided into age groups is small, the greater number of quarrels

at each age group minimizes the difficulty, for this is not primarily a normative study but rather an analysis of the quarrel-situation.

FREQUENCY AND DURATION OF QUARRELS

Average number of quarrels per hour. The results for frequency and dura-

TABLE 1

Frequency and duration of quarrels

Hours of observation.....	58.75
Average number of quarrels per hour.....	3.40
Number outdoors.....	68
Number indoors.....	132
Average number of children per quarrel.....	2.22

Duration of quarrels in seconds

	OUT-DOORS	INDOORS	ALL
Average.....	34.48	18.45	23.63
Median.....	21	13	14

Individual frequencies

Total individual frequencies.....	444
Average number of quarrels per child.....	12
Range in number of quarrels per child.....	0-39
Total quarrels for boys.....	271
Total quarrels for girls.....	173
Average number of quarrels for boys.	13.55
Average number of quarrels for girls.	9.61

tion of quarrels are shown in table 1. For the total 200 quarrels there are 58.75 hours of observation with an average of 3.4 quarrels per hour. The smallest number in an hour is one, the maximum nine. Studies on adult subjects, for example by Gates (13) and Richardson (22), showed anger outbursts much less frequent, yet this

undoubtedly is largely the result of repression by social forces.

Quarrels outdoors—quarrels indoors. There are 68 quarrels outdoors, and 132 indoors. The greater number of quarrels indoors is partly the result of more time being spent in indoor observation, yet the impression is that the children quarrel more frequently when they are in more crowded quarters.

Average duration of the quarrels. The duration of these quarrels is amazingly short. The range is from four to one hundred seventy-nine seconds; the average is 23.63. Of the 200 quarrels only 13 are a minute or over in duration. Table 1 gives the average and median duration for the quarrels.

Duration indoors and outdoors. The quarrels outdoors average 34.48 seconds in duration; those indoors average 18.45. The difference seems partly explainable by the fact that the children are more likely to chase each other around when outdoors.

Effect of teacher interference on duration. It was thought that perhaps the brevity of the quarrels was the result of the teacher's interference. To test this those quarrels in which the teacher took a hand are compared with those which the children settled themselves.

Outdoors the average duration of those quarrels in which the teacher interfered is 35.86 seconds; the average duration of quarrels with no interference is 34.54. Indoors, on the other hand, the average duration when the teacher interfered is 15.34; when there was no interference the average duration is 19.54 seconds. Although (as will be shown) the teachers inter-

fered outdoors as often as indoors, evidently they terminated the quarrel indoors more quickly. This may be because the quarrels indoors are more disturbing in a situation where the children are playing closely together.

However, in any event the quarrels are so short that we may conclude that their brief duration is a true characteristic and not a function of interference on the part of the teacher.

Individual differences in duration. The average duration of all the quarrels in which each child engaged was also computed. A rank order correlation of $.31 \pm .105$ between average duration and age indicates a slight tendency for the quarrels of the older children to last longer than those of the younger ones. See table 3. However, these average durations may not truly represent the individual children since the duration of the quarrel may be determined by a single child. A rank order correlation of $-.09 \pm .117$ between average duration of the quarrels and frequency of quarreling indicates no relation.

When we compare these results with those found by Gates (13), Richardson (22) and others we may safely conclude that the quarrels of preschool children are remarkably shorter than those of adults. Reports would also indicate that these quarrels are shorter than those of older children. Certainly they are too brief to contain the various stages that Bovet described in his study of quarrels among school boys.

Average number of children involved. By totaling the individual frequencies in quarreling for all the quarrels it is found that the children quarreled 444

times, making an average of 2.22 children in each quarrel. The greatest number of children in a quarrel at any time was five. Parten found that children of this age play in small

quarreling. The sex differences in frequency are given in table 1. For all the quarrels combined the boys quarrel approximately 13.55 times each; the girls, 9.61. Comparing the frequencies for the sexes within the same age groups (see table 2) we find that the boys still exceed girls considerably in all but the 30-41 month group. It would seem, then, that the greater frequency of quarreling among boys is a true sex difference. The results of other investigations confirm this finding.

Age differences in frequency of quarreling. This study indicates that there is a tendency for quarrelsome-

TABLE 2
Age and sex differences in frequency of quarreling
(Expressed in number of quarrels per hour)

AGE	BOYS	GIRLS	ALL
54-65	.442	.210	.312
42-53	.689	.371	.527
30-41	.614	.699	.669
18-29*	.613		.613

* No girls in lowest age group.

TABLE 3
Correlations of frequencies and duration of quarrels with other factors

	P	SPEARMAN-BROWN CORRECTION
Reliability:		
Frequency of 1st 100 with frequency of 2nd 100.....	.63 ± .07	.77
Frequency of odd 100 with even 100.....	.83 ± .03	.91
Duration of quarrels:		
Average duration and increasing age.....	.31 ± .105	
Average duration and frequency of quarrels.....	-.09 ± .117	
Frequency of quarrels:		
Gross frequency and equated frequency (1st 100)...	.97 ± .006	
Gross frequency and equated frequency (2nd 100)...	.94 ± .013	
Frequency and increasing age.....	-.41 ± .09	
Frequency and number of days present (1st 100)...	.13 ± .116	
Frequency and number of days present (2nd 100)...	.11 ± .111	
Frequency and IQ.....	-.17 ± .114	
Frequency and number of different children with whom quarreled.....	.95 ± .01	

groups the greatest proportion of the time.

Average number of times children quarrel. For the 200 quarrels the children average approximately 12 quarrels each. The range is from 0-39.

Sex differences in frequency of quar-

reling. The sex differences in frequency are given in table 1. For all the quarrels combined the boys quarrel approximately 13.55 times each; the girls, 9.61. Comparing the frequencies for the sexes within the same age groups (see table 2) we find that the boys still exceed girls considerably in all but the 30-41 month group. It would seem, then, that the greater frequency of quarreling among boys is a true sex difference. The results of other investigations confirm this finding.

Age differences in frequency of quarreling. This study indicates that there is a tendency for quarrelsome-

ness to decrease with age. The rank order correlation between age and frequency of quarreling is $-.41 \pm .09$. See table 3. Conclusions can not be certain because of the small number of cases, yet quarrelsome ness seems to be a trait that changes with age.

The question also arises here: are

the differences found functions of age and sex or of the personality of the individuals who make up the groups, or of both? That is, will two-year old Chester be as quarrelsome at five years as he is now; will he be any more quarrelsome than the average five-year old; will he be more or less quarrelsome than the average two-year old? The answer can be given only by repeating the study on larger numbers of children in both segregated and non-segregated age and sex groups.

Frequency of quarreling and attendance. The frequencies were equated for absences because it was thought that the child who was present every day might exceed in frequency of quarreling the child who was absent a great deal, merely by virtue of the fact that he was present for observation more often. However, rank order coefficients of correlation between gross frequency and frequency after absences were equated of $.97 \pm .006$ for the first 100 and of $.94 \pm .013$ for the second 100 indicate that gross frequency is almost as good a measure as equated frequency. Coefficients of correlation between frequency of quarreling and number of days present are $.13 \pm .116$ for the first 100 and $.11 \pm .111$ for the second 100; this, too, would indicate that the number of days present has little effect upon frequency of quarreling.

Frequency of quarreling and IQ. The rank order coefficient of correlation between frequency of quarreling and IQ is $-.17 \pm .114$ which indicates that the relation is slight. However, it is in the same direction as those found by Stratton (24) between IQ and emotion scores, and by Olson

(20) between IQ and problem tendencies.

Frequency of quarreling and socio-economic status. The frequency of quarreling according to socio-economic status is presented in Table 4. Occupations are rated according to the Minnesota Occupational Rating Scale, in which Group I is professional, II, semi-professional and managerial, III, clerical, skilled trades and retail business, IV, semi-skilled occupations, minor clerical positions and minor business, V, slightly skilled trades and other occupations requiring little training or ability, VI, day laborers.

TABLE 4
Relation between frequency of quarreling and socio-economic status

(Showing average number of quarrels per hour)

Group I.....	236	331
Group II.....	427	
Group III.....	335	
Group IV.....	269	
Group V.....	219	

The implication that those of lower status quarrel less often is an interesting one but should be checked by studying a larger sampling, in order to ascertain whether these differences depend on the individual personalities within the group or whether they are truly affected by status.

SIMILARITIES IN AGE AND SEX OF
CHILDREN WHO QUARREL
TOGETHER

Number of different children with whom children quarrel. A chart was made showing every child with whom each child quarreled. The range for the 200 quarrels is from the child who

quarreled once with one child to the one who quarreled 42 times with 29 different children. The average per child is 14.6 quarrels with 11.5 different children. In other words, the average child seems not to have any particular "enemies." As we would expect, a rank order coefficient of

gether. Charts were made showing the age and sex of every child with whom each child quarreled. The percentages of quarrels with older children, children of the same age, younger children, and between those of the same, and of the opposite sex were computed. A range of six months was used to differentiate between the children. In general the children quarrel most often with those of the same sex but of different ages. See table 5. But the youngest and oldest children almost necessarily had to quarrel with children of a different age since other children of the same age were few in number. The quarrels of the middle groups of children, on the other hand, who have equal opportunity to quarrel with children older or younger than themselves are divided almost equally between those with children of the same age and those with children of different ages. Evidently then the age of those with whom the child quarrels is largely determined by opportunity. Whether the children would quarrel more frequently if the age groups were segregated, as they are in some nursery schools, is an interesting question.

TABLE 5*
Similarity in age and sex of children who quarrel together
(Expressed in percentage of total number of quarrelers)

BY AGE	OLDER	SAME AGE	YOUNGER
54-65	3.7	30.3	65.8
42-53	18.6	44.6	36.7
30-41	38.1	48.8	13.1
18-29	73.5	26.4	0
All ages:			
Between same age.....	39.9		
Between different ages.....	60.8		
BY SEX	SAME SEX	OPPOSITE SEX	
54-65	58.2	41.7	
42-53	61.7	38.2	
30-41	47.1	52.8	
18-29	58.4	41.5	
All	55.6	44.3	

* The percentages in this and subsequent tables are based on the number of children involved in the quarrels. In all 200 quarrels the 40 children participated 444 times. The base for computing percentages for all ages was, therefore, 444.

correlation of $.95 \pm .01$ between frequency of quarreling and number of different children with whom the child quarreled indicates that those who quarrel most often quarrel with the greatest number of children. See table 3.

Age and sex of those who quarrel to-

ANALYSIS OF THE QUARRELING SITUATION

Difficulties over which quarrels start. As described before, the difficulties were classified into several categories. The percentages falling in each category are given in table 6.

Disregarding for the moment the age differences, we find that quarrels over possessions lead very clearly, with the rest of the quarrels divided about equally between the other types.

Age and sex differences in difficulties. Quarrels over possessions lead at all ages, the number of this type decreases consistently with age, and, in general, the number of quarrels of the other types increases with age. See table 6.

TABLE 6
Types of difficulties over which quarrels start

BY AGE	POSSES-SIONS	PHYSICAL VIOLENCE	INTER-FER-E WITH ACTIVITY	SOCIAL ADJUST-MENT
54-65	38.4	26.9	19.2	15.3
42-53	53.9	12.6	22.2	11.1
30-41	61.0	11.6	15.5	11.6
18-29	73.5	8.8	14.7	2.9
All ages	58	13.5	18	10
BY SEX				
Boys	60.1	12.3	15.2	12.3
Girls	53.2	16.1	24.1	6.4

TABLE 7
Types of behavior exhibited by quarrelers

BY AGE	PRECIPITATOR	AGGRESSIVE	RETALIATIVE	OBJECTING	UNDIRECTED ENERGY	PASSIVE
54-65	39.3	65.1	47.0	7.6	0	4.5
42-53	37.9	48.2	59.6	10.8	4.2	3.6
30-41	47.5	36.4	47.5	16.1	6.8	7.3
18-29	68.0	24.0	34.0	16.0	18.0	14.0
All ages	45.0	43.7	50.5	12.8	6.1	6.3
BY SEX						
Boys	51.5	46.1	49.5	11.8	4.8	7.0
Girls	34.6	39.9	52.0	14.4	8.1	5.2

It is interesting to note that both the number of quarrels over possessions and the number of precipitators decrease with age. Since the majority of the quarrels originate over possessions it is not surprising to find the youngest children starting the most

quarrels since they have not yet learned to share their toys.

Goodenough (14) found that difficulties over possessions reached a maximum frequency between the ages of three and four, while this study finds that the youngest children start the most quarrels. The difference between the studies, however, may very well be the result of differences in the social situation; the two year old at home would not be surrounded by children as near his own age, all wanting the same toy.

The boys consistently start more quarrels over possessions and over social adjustment than do the girls; while the girls consistently exceed in number of quarrels caused by physical violence and by interference with activity. Those of the "weaker" sex,

at this tender age, have still to learn of the exclusive superiority of the male in the domain of brute force!

Type of behavior during the quarrel. Table 7 presents the percentage of quarrelers who displayed each type of behavior.

An interesting age difference is that the younger children start the most quarrels, and that the number of precipitators decreases with age. Although the younger children start more quarrels they take a less aggressive rôle during the actual struggle, or offer no resistance to the more violent behavior of the older children. But as the children grow older retaliation and aggressiveness increase. Both Hall (16) and Levy (17) found this same age difference when they noted

very likely less aggressive because they quarrel most often with the older children. It would be interesting to determine how these differences would change if the age groups were segregated. In that event the type of behavior would be more a function of individual personality than of age.

The percentages listed under *all ages* indicate that aggressiveness and retaliation are general characteristics of all quarrels, whereas objecting, undirected energy, and passive behavior

TABLE 8
Motor activity exhibited by quarrelers

BY AGE	PUSHING	STRIKING	PULLING	KICKING	PINCHING	STAMPING	THROWING THINGS
54-65	40.9	36.3	30.3	9.1	1.5	0.0	0.0
42-53	40.3	36.1	32.5	6.0	2.4	1.2	1.2
30-41	22.6	32.5	38.6	1.2	5.5	3.1	2.4
18-29	18.3	28.5	22.4	0.0	0.0	4.1	2.4
All ages	31.3	34.0	33.3	4.1	3.1	2.0	2.9
BY SEX							
Boys	31.7	36.8	30.9	4.05	1.4	1.1	3.3
Girls	31.2	29.9	36.9	4.04	5.7	3.4	2.3

that the resistant responses of older children became more definitely directed against the offending person or object.

As for sex difference, the more aggressive behavior and the more frequent precipitation of quarrels on the part of the boys would seem to uphold the popular opinion that boys are more pugnacious than girls.

These types of behavior are undoubtedly affected by the age, and to some extent the sex, of those who quarrel together. For example, the behavior of the younger children is

characterize only a small percentage of them.

Motor activity during the quarrel. The percentage of quarrelers who display each type of motor activity appear in table 8. For the sake of brevity activities of infrequent occurrence, e.g. sticking out the tongue, are omitted here. At all ages pushing, striking and pulling are the most common motor activities. The older children exceed the younger in frequency of the more violent forms of activity; this agrees with the finding that the older children play a more

aggressive rôle. The differences between the sexes in motor activity are not particularly striking. When young children quarrel, motor activity seems an almost inevitable accompaniment; in only three of the 200 quarrels is there no motor activity.

Vocal activity during the quarrel. In most of the quarrels comments were recorded verbatim. Vocal activity was classified as crying, forbidding and commanding, making factual comments ("you hurt me," "I had it

Crying is the only behavior in 29.5 per cent of the quarrels; and crying on the part of one or more children occurs in 53.5 per cent of the quarrels. Threats occur in 7.5 per cent; forbidding and commanding in 43 per cent; comments of fact are made in 16 per cent; consolation is offered in 1.5 per cent; and names are called in 2 per cent of the quarrels. Thus, crying and forbidding and commanding are the most common types of vocal activity, while silence occurs more often than any single

TABLE 9
Vocal activity exhibited by quarrelers

BY AGE	SILENT	CRYES	FORBIDS	THREAT-ENS	FACTUAL COMMENTS	CONSOLES	CALLS NAMES	RECIPRO- CAL	NON-RE- CIPROCAL
54-65	33.3	9.1	39.3	13.6	16.6	3.0	4.5	18.1	43.9
42-53	36.7	27.1	24.6	4.2	17.5	0.6	0.6	16.8	23.4
30-41	49.6	30.6	23.3	0.6	2.4	0.0	0.6	5.5	19.6
18-29	63.2	32.6	2.0	0.0	2.0	0.0	0.0	0.0	4.0
All ages	43.8	26.3	23.8	3.8	10.1	0.6	1.1		
BY SEX									
Boys	45.7	20.2	28.0	4.4	9.2	1.1	1.1	11.4	25.4
Girls	41.0	35.8	17.3	2.8	11.5	0.0	1.1	10.4	19.1

first"), threatening, condoling ("I won't do it any more," "don't cry"), and calling names. The remarks were classified as reciprocal when one child answered the other, or as non-reciprocal when only one child talked or when the remarks were made independently (similar to Piaget's "collective monologue").

The percentage of the 200 quarrels in which each type of vocal behavior occurred was computed. In 15 per cent of the quarrels no vocalizations at all occur; and in 77.5 per cent at least one of the participants is silent.

form of vocalization. Hall, too, found crying the most characteristic vocal response. The remarks are reciprocal in 11 per cent of the quarrels and non-reciprocal in 44.5 per cent. This points to the infrequent occurrence of the argumentative type of quarrel.

The percentage of quarrelers displaying each type of vocal activity is given in table 9. The same order of frequency holds as above.

Age and sex differences in vocal activity. Table 9 also presents the age and sex differences in vocal activity. Silence and crying decrease with age.

Non-reciprocal remarks exceed the reciprocal at all ages. Girls, in support of public opinion, exceed boys in crying; they also exceed the boys very slightly in number of factual comments.

It may well be that the frequency and duration of quarrels change with the type of quarrel. In the older children we see the beginnings of the argumentative type of quarrel so

majority of the quarrels themselves, most often by one child's yielding to force on the part of another child; one is definitely the "victor."

Evidently the teachers supervise as closely outdoors as indoors, for they interfere outdoors in 35.2 per cent and indoors in 35.6 per cent of the quarrels.

Age and sex of those to whom children yield, compromise. Table 11 presents the age and sex of those to whom the child is forced to yield, to whom he yields voluntarily, and with whom he compromises, giving the percentage of each type according to age and sex. Most often, as we would expect, a younger child is forced to yield to an older child; and most often it is the older who voluntarily gives in to the younger. Only rarely does a younger

TABLE 10
Outcome of the quarrels

	per cent
Child yields to force.....	47
Child yields voluntarily.....	10
Compromise.....	5.5
Child interferes.....	2
Teacher interferes.....	35.5

TABLE 11
Influence of differences in age and sex on outcome

	YOUNGER TO OLDER	SAME AGE TO SAME AGE	OLDER TO YOUNGER	SAME SEX	OPPOSITE SEX	BOTH SEXES
	per cent	per cent	per cent	per cent	per cent	per cent
Yield to force.....	47.3	43.1	9.4	53.6	41	5.2
Yield issue voluntarily.....	15	35	50	50	45	5
Compromise.....	22.2	22.2	25.9	66.6	18.5	14.8
			29.6*			

* Ages combined.

commonly observed in later childhood. Such lengthy arguments are undoubtedly responsible for the popular opinion that older children spend more time in fighting than they do in playing. These "quarrels" however are of a different type than the brief physical conflicts of the younger subjects.

Outcome of quarrels. The percentage of quarrels settled by each of the various means is given in table 10.

Obviously the children settle the

force an older child to yield, and rarely does a younger child yield voluntarily to an older child. Sex differences are not striking. In each category the "Same Sex" heading leads, the result, no doubt of the fact that children quarrel more often with those of the same sex.

After effects. Table 12 shows the percentage of quarrels after which the children are cheerful or resentful.

Evidently the children recover from

their quarrels very quickly for they are cheerful far more often than resentful after quarreling. The sex differences here are negligible. The studies of adults would indicate that they are more likely to have unfavorable after effects and that such reactions persist longer than is the case with these young children. Certainly the impression given is that the young child's emotions are quickly aroused and quickly dispelled.

THEORETICAL AND PRACTICAL
IMPLICATIONS

The greater frequency of quarreling indoors in crowded playrooms suggests

TABLE 12
After effects

	ALL	BOYS	GIRLS
	per cent	per cent	per cent
Cheerful.....	76.5	77.4	75.1
Resentful.....	23.4	22.5	24.8

that the mother who wishes a peaceful household should encourage outdoor play whenever the weather permits, and should provide ample play space indoors.

Quarrels are so short that the mother or teacher will find that the majority are settled before she has time to interfere. As our results show, might usually makes right at the preschool level, and to be sure, justice is not always done. Certainly one should interfere to protect the child from serious physical injury and probably to prevent too much domineering on the part of an older and stronger child. In general, however, it would seem wise to let children fight their own

battles. The mother or teacher who continually interferes is depriving the child of excellent opportunities to learn social adjustment.

The tendency for quarreling to decrease with age is in line with studies showing that anger outbursts for adults are less frequent than in children. This difference may well be the result of social pressure; and certainly the type of quarreling differs, for adults use a variety of substitutes in place of the direct physical attack of the child.

The fact that children quarrel most often with those of the same sex is related to the findings of investigators such as Parten (21) and Challman (11) who found that children played most often with those of the same sex. That children seem to differentiate in regard to sex in their friendships as well as in their quarrels suggests a possible relation between friendship and enmity. The increase with age in quarrels arising over social adjustment is also in line with the increase in group play found by Challman, Parten and others. As social relations become more complex, difficulties of group adjustment increase.

Since the majority of quarrels start over possessions it is not surprising that the youngest children, who have not yet learned to share their toys, start the most quarrels. And though their resistance is less effective we see that even the youngest children almost invariably attempt to stand up for their rights. Of course the type of behavior displayed depends upon the immediate situation; a child may dominate one playmate and yet yield to another. For this reason it would seem wise not to segregate age groups

too sharply, for the child needs practice in adjusting to a variety of social situations. Again, the parent who continually forces the older child to yield to the younger harms both. Likely as not the younger was at fault, and he too must learn to share, give and take.

The most striking thing about motor activity is that it is almost invariably present as the most prominent aspect of the quarrel. The brevity of the quarrel and the apparent lack of disagreeable after effects would indicate that the child "drains off" his anger through motor activity and gets it out of his system. In the adult who, let us presume, suppresses the more primitive impulses and substitutes vocal repartee, quarrels last longer and are more likely to have unfavorable after effects. In this study the increase in reciprocal remarks among the older children is paralleled by increasing duration of quarrels. The efficacy of action in contrast to argumentation finds support here.

SUMMARY

1. The average duration of the quarrels, 23 seconds, is surprisingly short. Quarrels of the older children last longer than those of the younger. The brief duration of the quarrels seems a true characteristic and not a function of teacher interference, although the teachers do terminate quarrels indoors more quickly than quarrels outdoors.

2. Boys quarrel more frequently and are more aggressive during quarrels than girls.

3. Quarrelsomeness tends to decrease with age; at least quarrels of the type studied do.

4. The youngest children start the most quarrels but take the less aggressive rôle during the quarrel. As children grow older aggressiveness and retaliation increase.

5. A very slight negative relation is found between I.Q. and frequency of quarreling.

6. Children quarrel most often with those of the same sex, who are, however, either older or younger than themselves. The latter difference seems influenced by opportunity.

7. The majority of quarrels are started by a struggle for possessions. The number of quarrels of this type decreases with age but still holds the lead over other types at all ages.

8. Pushing, striking and pulling are the most common motor activities. The older children indulge in the more violent forms more often. In only 3 quarrels is there no motor activity.

9. Crying, forbidding and commanding are the most common forms of vocal activity, although silence is a more frequent reaction than any single activity. Talking during a quarrel increases with age but reciprocal conversation is rare. There is some indication that quarrels of the argumentative type increase with age.

10. The average number of quarrels per hour is three to four, although this is probably an underestimation of the total quarreling of this group. There seem to be more quarrels indoors when the children are crowded together.

11. The children settle the majority of the quarrels themselves, most frequently by one child's forcing another to yield. Most often the younger child is forced to yield to the older; and most often it is the older who yields voluntarily to the younger.

12. The great majority of the children recover after a quarrel very quickly and show no evidence of resentment.

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The Relation between Situation and Response in Vocalization of a Three Year Old Child¹

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INTRODUCTION

THE purpose of the present study was to determine what effect, if any, the immediate environment has on the *quantity* of vocalization in a child. An effort was made to find out whether the average number of utterances per minute is relatively the same in all situations which are familiar to the child in which he is allowed to engage in free play or whether this amount differs from one situation to another.

In planning this experiment it was considered more worth while to make a thorough study of the conversation of one child rather than to take fewer records per subject on a large number of children.

Procedure

This study consisted of taking detailed records of the vocal sounds of one subject in different environmental situations. The five situations presented, all of which were familiar to the subject and relatively constant and in which the child was allowed to engage in free play, were as follows:

¹ The writer wishes to acknowledge her indebtedness to Dr. Wayne Dennis, under whose direction this research was performed.

1. *In the home.* The subject had free access to play in any room of a six-room apartment all of which was located on the same floor. The parents of the child were usually in the apartment when the records were taken, but gave the subject no especial attention during the experimental periods.

2. *In the sandpile.* The sandpile was located out of doors and was comparatively isolated, being surrounded by a grove of trees on one side and a garage on the other. The street was not visible from its location. The subject had played alone in this sandpile at frequent intervals for twelve months prior to this experiment.

3. *In nursery school with children.* The subject had been enrolled in the nursery school for a period of four months when the experiment began. She was acquainted with each of the seven other children in the nursery. The children were of approximately the same age and had been enrolled for the same period of time. Play in the nursery school was restricted to one room. The school was furnished with the usual equipment. The children spent two morning hours in the nursery.

4. *In bath.* The subject was al-

lowed to play at home in the bath tub filled about one-third with water. She had been previously accustomed to playing in the water before being bathed.

5. *In the nursery alone.* The child was taken in the afternoons to the same nursery which she attended each morning, but she was alone in the play-room except for the experimenter.

For comparative purposes four additional situations in which the activities of the child were somewhat constrained were presented. Each of these situations presented some factor which might be expected to reduce the quantity of linguistic responses. These situations were as follows:

6. *Auto ride.* The subject was taken for rides in the country in the family automobile (a Terraplane roadster) driven by her father. The speed of the car was kept at approximately twenty miles per hour.

7. *Listening to music.* Music consisting of records of nursery rhymes was played on a victrola which was in the living-room of the child's home.

8. *Eating an ice-cream cone.* The subject was given a vanilla ice-cream cone to eat. The cone was always eaten in the living-room of her home.

9. *At a moving-picture show.* The child was taken to a theater which she had previously visited to see a movie, "State Fair," in which Will Rogers was starred. She had previously seen movies and had been trained to inhibit talking in this situation.

The movie record was a continuous two-hour record, divided into fifteen-minute intervals, but each of the other situations was presented for fifteen minutes, or only a fifteen minute record was taken at a time. Each

sort of situation was presented ten times, two of a kind never being presented on the same day. Otherwise the situations were presented in a random order. Experimentation was begun at the same hour (4:00 P.M.) each day and on approximately seven days per week. In general, two situations per day were presented—the second being presented immediately following the first.²

The subject used in this experiment was an only child who had always been under the constant care of her parents. She had served as subject of a previous experiment and was, therefore, well acquainted with the experimenter when this study was made. The child was strong, robust and emotionally stable. According to the Stanford Revision of the Binet-Simon Test, her I. Q. was 156. The experiments were begun within one week after the subject had passed her third birthday.

In recording the vocalizations, all sense material was written down verbatim. The nonsense responses and "sing-song," which consisted of vocalizations uttered in a monotone, were indicated quantitatively, but no accurate phonetic record was attempted.

The experimenter did not talk to the child during an experimental period except when asked a direct question, and apparently the subject did not notice the fact that records were being taken.

RESULTS: TOTAL RESPONSES

The quantitative analysis of the records consisted of counting the total number of responses during each ex-

² The time required for the performance of this experiment was approximately thirty minutes a day for seven weeks.

perimental period. In this count a response consisted of a meaningful word, an incomprehensible or nonsense word, or an accent or beat of "sing-song." No doubt personal interpretation of the experimenter entered somewhat into the recording and counting of these responses. There is, however, no reason to believe that the experimenter *recorded* differently in the different situations, so that differences or uniformities between the situations would be false. Following the usual procedure, contractions of the subject and verb were scored as two responses, whereas, contraction of the verb and negative, and hyphenated words were

each of the four constrained situations was lower than in any of the five free-play situations. While no table of reliabilities for the constrained situations is presented, the figures were computed. The difference in quantity of vocalization between any one of the five free-play situations and the auto, music, ice-cream cone, or movie situation was found to be reliable.

3. A reliable difference in the quantity of vocalization was also found between any two of the four constrained situations, the order of the situations from highest to lowest number of vocalization being: (1) auto, (2) music, (3) ice-cream cone, (4) movie.

TABLE 1

	FREE-PLAY SITUATIONS					CONSTRAINED SITUATIONS			
	In the home	In the sand-pile	In the nursery with children	In bath	In nursery alone	Auto ride	Listening to music	Eating ice-cream cone	At a movie
Average number of linguistic responses.....	423.6	534.5	437.5	453.1	480.6	239.6	139.9	57	39

scored as one response. Table 1 shows the average number of linguistic responses for each experimental situation. The reliability of the differences in the average number of responses from situation to situation was then computed. $\frac{D}{\Sigma \text{Sigma } D}$ for the average number of responses in the free-play situations are shown in table 2.

The tables show the following facts:

1. No reliable difference in the total amount of vocalization occurs between any two of the five free-play situations; namely, the home, sandpile, nursery with children, bath, and nursery alone.
2. The number of vocalizations in

The fact that the differences in amount of vocalization in the five free-play situations were unreliable is of significance. The child was well adapted to the home, the sandpile, the nursery with children, the bath, and the nursery alone, each of which was a relatively stable situation. The quantity of vocalization had reached a constant level in these situations and showed no significant fluctuation from one experimental period to the next.

Thus the results obtained show that talkativeness was a constant trait in this child in these five familiar, stable environmental situations when the subject was allowed to engage in free-

play. The results suggest that vocalization was highest in this sort of situation. At least, no situations which we presented resulted in higher records.

The fact that the quantity of vocalization was lower in the four constrained situations shows that the "normal" flow of vocalization may be inhibited probably by such factors as conflict of activity, unfamiliarity, quickly changing scenery, or by auditory stimuli such as the noise of an auto motor or music which must be "talked above" in order for the con-

other subjects would tend to show the same characteristics. At present it is no doubt best merely to conclude that the vocalization of *some* children is in accord with the generalization stated above. In our opinion it is more important to know the detailed behavior of some concrete individuals than to know the average performance of many subjects, no one of which may conform to the averages derived from the whole group.

Results: Kinds of responses

In making a study of the records it was apparent that whereas the amount of vocalization is the same for all free-play situations, the type of conversation differs in the various situations.

It was therefore considered worth while to make a further analysis of these records in order to show that while the immediate environmental situation does not affect the total number of responses it does affect the frequency of some types of responses. An effort was made to devise some method of tabulating the responses which would show how the frequency of certain kinds of vocalizations differs from one situation to another.

This analysis of the records consisted of counting the following items:

(1) The number of times objects *present* in the immediate environmental situation were mentioned.

(2) The number of times objects *absent* from the immediate environment were mentioned. Absent objects were counted either as *remembered* objects or *anticipated* objects. *Memory* objects consisted of relating an event or mentioning an object with which the subject had experienced in

TABLE 2
 $\frac{D}{\Sigma D}$ for the average number of responses
 in the free-play situations

	IN THE HOME	IN THE SANDPILE	IN NURSERY WITH CHILDREN	IN NURSERY ALONE
In sandpile.....	2.55			
In nursery with children.....	0.30	2.51		
In bath.....	0.55	1.6	0.28	
In nursery alone.....	1.5	2.1	1.3	0.82

versation to be heard. Such factors may explain the decrease in the amount of vocalization in the auto situation, the movie, the ice-cream cone, or while the subject was listening to music.

Thus the present data suggest the theory that all stable, familiar situations lead to the same quantity of vocalization, that no situations lead to a greater quantity than these, but that some situations do inhibit vocalization. Obviously this theory needs to be tested on a larger number of children in order to determine whether

the past; for example, "I had a cake on my birthday." *Anticipation* included mention of any object or event to which the child looked forward; for example, "Where are we going to live in the summer?" In counting each of the first two items (present objects and absent objects) described above, the number of "times" a given kind of object was mentioned means the number of sentences in which such objects were mentioned. However, incomplete sentences were considered as well as completed ones.

(3) The number of proper nouns or personal pronouns which referred to imaginary playmates.

(4) Number of sentences addressed directly to a person present in the immediate experimental situation.

(5) The number of periods of "sing-song" responses which occurred. A period is a series of vocalizations in "sing-song" set off at either end by vocalizations not pronounced in a "sing-song" manner.

(6) The number of periods of non-sense which occurred. Here, as above, a period is a series of vocalizations in non-sense set off at either end by vocalizations not pronounced in non-sense.

In some cases a sentence was counted under more than one item. For example, "I will give this to Lucy when I go." In the preceding sentence "this" referred to a present object, "Lucy" referred to an imaginary play-mate, and "when I go" referred to anticipation. Thus the above sentence was counted separately under each of the three items (present objects, imaginary playmates, and anticipation). If the above sentence was

addressed directly to a person present in the immediate environmental situation (a fact recorded in the records), it was also counted under item four.

The average number of times each item occurred in each of the situations studied was obtained, and this average is shown in table 3 below. The reliability of the differences in the average of each of these items from situation to situation was then computed. Table 4 shows these reliabilities expressed in

D

Sigma D'

The results show that while the situations did not differ in the total responses which they elicited, they did differ markedly in the frequency with which they called forth certain kinds of responses.

1. *Objects present* in the immediate environment were mentioned a reliably greater number of times when the subject played in the nursery with the other children present than when she played in the nursery alone.

2. *Remembered objects* played a reliably smaller part in the child's conversation while in the nursery with children than while playing at home or in the sandpile.

3. *Anticipation* was reliably greater in the home situation than in either the nursery with children, nursery alone, or bath situation.

4. *Mention of imaginary playmates* was reliably smaller when the subject played in the nursery with children than when she played at home, in the sandpile, or in the nursery alone.

5. *Sentences addressed* directly to a person "in the nursery with children" situation outnumbered those in each of the four remaining free-play situa-

TABLE 3
Average frequency of each type of response

AVERAGE	FREE-PLAY SITUATIONS					CONSTRAINED SITUATIONS			
	In the home	In the sand-pile	In nursery with children	In bath	In nursery alone	Auto ride	Listening to music	Eating ice-cream cone	At a movie
Present objects.....	45.7	37.8	53.9	44.2	32.1	23.7	19.2	9.4	5.3
Absent objects:									
Memory.....	2.6	3.2	0.7	2	1.2	1.2	0.1	0.6	0
Anticipation.....	9	6.1	3.7	4.4	5.5	8	0.4	0.3	1.9
Imaginary playmates.....	11	14.1	0	15.3	13.7	0	0	0.1	0
Sentences addressed to person.....	16.5	3.5	56.6	49	4.9	1	27.6	10.4	6.3
Periods of sing-song.....	5.9	14.1	8.1	9.4	8.4	2.3	2.7	0	0
Periods of nonsense.....	4.1	13.4	7.3	7.5	8.6	2.2	0.3	0	0

TABLE 4
 Δ
Sigma Δ for each type of response in free-play situations

	PRESENT OBJECTS				REMEMBERED OBJECTS			
	In home	In sandpile	In nursery with children	In bath	In home	In sandpile	In nursery with children	In bath
	In sandpile.....	1.7			0.61			
In nursery with children.....	1.6	4.4			3.00	3.07		
In bath.....	0.34	1.3	2.04		0.73	1.2	2.1	
In nursery alone.....	2.24	1.2	4.07	2.03	1.7	2.00	0.81	1.0
ANTICIPATION								
In sandpile.....	2.41				0.77			
In nursery with children.....	5.5	1.5			3.66	5.73		
In bath.....	6.5	1.5+	0.7		0.8	0.20	3.33	
In nursery alone.....	2.7	0.4	1.6	1.7	0.75	0	4.66	0.19
SENTENCES ADDRESSED DIRECTLY TO PERSON								
In sandpile.....	3.9				4.7			
In nursery with children.....	10.7	13.7			1.3	3.0		
In bath.....	4.0	0.31	14.4		2.4	2.89	0.63	
In nursery alone.....	7.1	1.2	18.6	2.0	1.4	3.46	0.17	0.71
PERIODS OF NONSENSE								
In sandpile.....	5.73							
In nursery with children.....	1.91	2.75						
In bath.....	3.85	2.73	0.65					
In nursery alone.....	3.47	1.91	1.09	0.71				

tions, i.e. in home, in sandpile, in bath, and in nursery alone. Next in order (high-low) of number of sentences addressed directly to a person was the home situation. The sentences directly addressed to a person in the home situation were reliably higher than those in the sandpile, nursery alone, or bath situations, and reliably lower than "in the nursery with children."

6. *Periods of sing-song* in the sandpile situation were reliably greater than in any of the other free-play situations.

7. *Periods of non-sense* in the home situation were reliably lower than in the sandpile, nursery alone, or bath situation. Periods of non-sense in the sandpile situation were reliably greater than in the home, in nursery with children, or in the bath situation.

Tables for the constrained situations are not presented to show the reliability of the differences in frequency of *types* of responses, but it is obvious that in these situations as in the free-play situations the kinds of vocaliza-

tion differ in frequency from one situation to another.

SUMMARY

Vocalizations of one three-year-old child were studied in five stable and familiar free-play situations and in four situations which might be expected to restrain the use of language.

The study showed that the average number of vocalizations per fifteen minute period—in which comprehensible, incomprehensible, and nonsense words, and "accents" in sing-song were counted as units of vocalization—did not differ between any two free-play situations. The kind of free-play situation did not affect the total output of vocal utterances.

However, the sort of responses which made up the total vocalizations varied markedly from one free-play situation to another.

The constrained situations reduced the amount of vocalization as was expected. These situations also differed among themselves in the absolute and relative frequency of different types of vocalization by the child.

Attitudes of Children Toward Their Own Bodies and Those of Other Children

MIRIAM S. DILLON

THE purpose of this study was to ascertain the attitudes of young children of both sexes toward their own bodies when undressed, and toward those of other children.

Two groups of nursery school children were used for observation. Group 1 consisted of 11 boys and 11 girls, whose mean age was 34.7 months with a range from twenty-seven months to forty-two months. The mean intelligence quotient was 117.8 with a range from ninety-nine to one hundred thirty-five. Group 2 consisted of 8 boys and 8 girls, from forty-two to sixty-two months in age, with a mean age of fifty-one months. The mean intelligence quotient of this group was 126.5 with a range from one hundred eight to one hundred forty-seven. The children of the two groups did not mingle with each other freely. They ate and slept on different floors of the same building, and special parts of the playground were assigned to each group. However, reasonable freedom was permitted the children to go from one group to another, especially on the playground. All the children ate their midday meal and took their afternoon sleep in the school. They undressed completely, and put on their pajamas for the nap. The dressing room for the younger group contained not only the children's lockers, but also the

wash basins and the toilets. The toilet and wash basins for the older group were in a bathroom adjoining the dressing room. There was no segregation of the sexes in either group. One adult was in charge of each dressing room and on some occasions there was an assistant. Adult observers were so common among the children during all their activities that they created no unusual situation.

Twenty-one observations on consecutive school days were made of each group during the dressing period, either before or following the afternoon sleep. The observation periods averaged twenty-five minutes.

The following behavior was recorded: manipulation of the genitals; interest in the different parts of the body other than manipulation of the genitals; interest in elimination; interest in the facts of sex differentiation; language used for elimination and parts of the body; use of tabooed language which involved elimination or the genitals; and demonstration of affection.

MANIPULATION OF THE GENITAL

In the younger group there were 14 instances of play with the genitals in some form. Four children were responsible for one instance each; two boys for 2 instances each; and one

boy was responsible for 4 instances. Whenever the behavior was noted by the teacher, the child's attention was diverted to some other activity without reference to his behavior. The diversion always appeared to be natural and unaccented. Four cases appeared to be motivated by curiosity about the structure of the organs.

For example, John had finished urinating, but a few last drops continued to form. He bent over to watch these, and appeared to be interested in the opening of the urethra. He pulled back the foreskin, watched the last drop appear and fall, was apparently satisfied, so flushed the toilet and returned to his task of getting dressed.) In 4 cases the behavior was momentary and appeared to be absent-minded, like the habitual biting of nails, or pulling at the lips, with no evidence of a conscious sensory response. In 4 instances the behavior, although of an absent-minded character, was prolonged. In these cases, the children were exceedingly unstable and the tic-like manipulation of the genitals accompanied crying, refusals to comply, interference with the activities of other children, and failure to persist in the task of dressing.

In the older group there were 20 cases of play with the genitals in some form. Six children were responsible for 1 instance each; 3 instances were observed for one girl, and 11 for one boy. There were 7 cases in which the manipulation was prolonged, 5 of which involved the same boy. In no case did the manipulation appear to be motivated by curiosity about the nature of the organs. In 18 cases, the manipulation appeared to be mechanical, like the activity of a tic.

An illustration of an habitual interest in play with the genitals is seen in the case of the girl. During the 21 observation periods she was observed handling her genitals on 3 occasions. On 2 of these occasions she appeared to be fully aware of what she was doing, and in one instance she seemed to obtain some sensory response. The child was sitting on the floor preparing to put on her union suits. Her knees were drawn up and apart and the vagina opening was exposed. Her face carried a dreamy, far-away look. She absent-mindedly picked up her shirt and in doing so the draw string chanced to pass over the vulva. Her attention at once became centered, she half smiled, and continued to pass the string slowly back and forth over the vulva. There was no effort to conceal the act, nor was the attention attracted of any of the other children who were dressing in the same room. The teacher diverted the child's attention by picking up her underwear, handing it to her, and saying, "See, the others are nearly ready to go out to play. You will have to hurry to catch up with them." Her attention was diverted immediately. There was no evidence of a sense of shame or guilt. However, she required continuous reminding in order to finish her dressing. It was reported later by the mother that this child was an habitual masturbator. Her general behavior in the school was unstable. She interfered with the activities of other children, had a short span of attention and dawdled over all routine procedures, including her eating.

One boy, 4 years old, was observed masturbating on 11 of the 21 observation periods. The play or manipula-

tion appeared to be a means for the release of tension. It ceased at once when the attention became centered on any definite activity. The penis was frequently erected, and the manipulation often consisted of drawing out the foreskin. On one occasion another boy observed him and remonstrated with him saying, "You will make yourself sore down there."

The manipulation of the genitals was not stimulated necessarily by nakedness, the presence of both sexes, or elimination. Rather, it seemed to be related to a state of emotional instability. The activity usually was not accompanied by a conscious sensory response apparently, but was a mechanical, motor reaction which served, perhaps, as a release of tension. Masturbation was much more frequent among the boys than the girls. This is to be expected because of the accessibility of the penis. In no case was there an attempt to conceal the play nor was there any indication of a sense of guilt or shame. When the manipulation was observed by the teachers they manifested no disturbance, but attempted to center the child's attention in a definite task or play.

Interest in parts of the body

A list also was made of incidents other than manipulation of the genitals in which a child manifested an interest in his own body or that of another child. Such behavior as examination of the navel, eyes, hair, or anus, was recorded; also stroking of the skin; calling the attention of other children to his body, or observation of himself in the mirror. The ordinary, necessary routine activities required in

washing the hands and face were not recorded.

Sixteen observations were recorded for the younger children. Four of these concerned one girl who had the habit of gently stroking the skin under the arms and over the ribs during periods when her attention was not actively engaged. Two similar instances were observed in the case of another girl. The navel interested one child on 2 occasions. She poked and pulled at it and made it go in and out by contracting and expanding the abdominal muscles. One boy was interested in his anus. The same child on another occasion joked about his buttocks in a way which indicated conditioning through contacts with children outside the nursery school. It was the commonplace occurrence of turning his back to another child, protruding the buttocks, and laughingly remarking, "Kick me *here*." Both children laughed and the incident was closed as other interests attracted their attention.

Another child exhibited a peculiar interest in her breasts. She was a rather listless child, under-weight from a serious illness, and always appeared drowsy during the preparations for the afternoon sleep. When sitting on the toilet during these periods she often sucked her thumb. At other times she wadded up pieces of toilet paper into soft balls, and placed one over each breast under her shirt, then patted them gently. She would remove them, then replace them several times, always patting them gently. They remained in place during the nap.

Two boys showed interest in the penis as in the following incident: Bob

sat upon the toilet for the purpose of evacuation. His knees were apart and his penis was conspicuous. Tom approached, noticed the penis and began to poke it. Bob laughed, and both children appeared to be amused watching it go up and down. "See your automobile!" said Tom. The activity was not concealed. The teacher diverted their attention to other interests. This interest, however, was not eliminated. Bob returned to the toilet and when it was suggested that he had sat there long enough he replied, "No, I want to make another automobile."

The behavior of most of the children during elimination was a matter-of-fact as brushing the hair. This is illustrated by the incident of Robert who came into the dressing room to urinate. Katherine was sitting on the toilet next to him. She evacuated, left the toilet, and joined a group of children at the window. Robert, flushing his own toilet, observed that Katherine had not flushed hers. Immediately he went over to her. "Have you finished?" he asked. "Come, then, and flush your toilet; then take some toilet paper and clean yourself off." Katherine complied, and when she had completed the routine, he departed, apparently satisfied.

Only one instance occurred which indicated that a child had been conditioned to regard elimination as a tabooed subject. Joe approached the teacher hurriedly, and drawing her head down close to his, he whispered. "B. M." This was the same child who had joked about his buttocks and had manifested a somewhat furtive interest in his anus.

One incident occurred which showed the contrast between the procedure maintained by the nursery school, and that still practiced in some families. John had been enrolled recently and was having difficulty in adjusting. Therefore his mother remained with him during the preparations for sleep. He timidly approached a toilet to urinate, closely followed by the mother who stood beside him, spreading her skirts between him and the little girl seated on the next toilet. "Hide the little boy! Let's hide the little boy!" she whispered audibly.

The beginning of a furtive or tabooed interest was observed in a form of play which the children developed. At various times a child's rectal temperature had been taken by one of the teachers. Some of the children began to imitate the performance in their play. A slender cylindrical block about three inches long was often used as a thermometer which they pretended to insert in the rectum. Sometimes one child undressed another but ordinarily this was not attempted. When the play first appeared the director of the nursery school tried to discourage it, with the result that the children withdrew to secluded places and continued it with increased interest. Therefore, she changed her method and suggested that they play in the customary situations. The children complied. The interest in the game continued spasmodically for five weeks and finally disappeared without any special interference. During this period only one instance was observed of an attempt to hide the play. In all other cases the play was not affected by the presence of adults. Although

this game spread to many of group 1 there were three older children who exhibited a more sustained interest than any of the others. Three instances were recorded in the dressing room during the observation periods which were related directly to this game. Ted brought a three inch nail into the room which he exhibited while undressing. Jane looked at it and immediately requested the teacher to take her temperature. "Are you sick, Jane?" Miss Ward asked.

Jane dropped her eyes an instant and replied, "Ye-s," rather slowly, then quickly shook her head, laughed, and said emphatically, "No!"

On another occasion, Miss Ward sat down on a chair in the dressing room with Hester in her lap and took the child's temperature. At first four children were interested in the procedure but they soon returned to their individual tasks. Martin, however, placed a little chair immediately next, where he could see. He peered into the thermometer and the child's anus, patted her buttocks gently, smiled at Miss Ward, and then sat contentedly observing and patting until the time was up. As Miss Ward left the room, he ran along behind her, saying, "Take my temperature, take my temperature, Miss Ward."

The interest which the children of the younger group displayed in this game appeared quite out of harmony with their other behavior toward the organs of elimination. The simplest explanation of their interest might be found in the first responses of the adults when the play appeared. Probably every adult who witnessed it experienced a feeling of revulsion

toward it, whether consciously expressed or not. Such reactions seldom are completely repressed and therefore the emotional quality may have been transferred to the children at the beginning. In any event, the early discouraging of the game increased its fascination. It lost its attractiveness when brought out into the open and the staff became schooled in reacting to it as towards other play. Whatever the explanation, the incident is significant because it demonstrated the ease and rapidity with which the excretory organs can take on a taboo lure, even at so early an age as three or younger; this, despite the routine of the dressing room periods, and the special training of the teachers. It was noticed, too, that the children who participated most frequently were the older ones of the group—that is, approximately three years of age.

The most noticeable behavior of the children of group 2 when undressed in the presence of other children or adults, was an absence of any sense of impropriety. The following is a typical illustration of their behavior:

Tom, age fifty-one months, had been sent upstairs to the dressing room from the playground to put on his sun suit. After removing his clothes, he found his sun suit so twisted that he was unable to straighten it out. As there was no one to assist him he ran down the stairs, among visitors, past the groups of children standing in the halls, out the front door and on to the play ground, waving the suit above his head. The teacher helped him solve his problem and his lack of clothes interested no one.

Seventeen observations were made

of a direct interest either in their own bodies or those of other children in this older group. This interest was different from that shown by the younger group. These children apparently were aware of what they were doing and frequently called the attention of other children to their behavior. In some cases the children seemed to present the same unemotional attitude toward one part of their body as another. For example Mildred stood beside the toilet while Ted was urinating. "What is that?" she asked.

"That is my penis."

"Girls do not have a penis," she remarked, looking up to the teacher for confirmation of her statement.

"That's right, Mildred," replied the teacher, "Only boys and men are made that way."

"And my Daddy, too," the child added. The tone of the conversation was exactly the same as if it concerned hats or spectacles.

One of the children exhibited a slight rash, so the teacher said, "Come, Helen let's take your temperature." As they left the room, Anne remarked, "You can put the thermometer in the mouth, in the anus, or under the arm." All three words were used in precisely the same tone of voice.

Frederick, Alicia, and Jane were awaiting their turn at the basin. Alicia pointed to Jane's breasts. "Do you know what this is? That means you have milk in your two little things. That's what happens when you have a baby."

Frederick added his bit, "Yes, that's for a baby."

On the other hand, there were occasions when a child would strut

around the room, with his abdomen protruding, slapping himself, and calling out, "See my big fat tummy!" Often the performance was taken up by other children. Sometimes the child enjoyed watching the effect in the mirror. They laughed, rolled their eyes mischievously and poked at each other. There was no attempt to hide the activity, and the teachers did not interfere except to call attention to the task of dressing. Such performances were engaged in by the children whose attention seemed easily scattered, who interfered with the persistence of other children, and who required the greatest amount of assistance in completing their routine tasks.

There was but one incident in which a child appeared to be aware of the conventional impropriety of appearing undressed before strangers. This was Nan who came from a family in which there were 4 children, 2 of whom were boys. She had attended the nursery school for two years. On this occasion there were boys and girls and 2 adults in the dressing room, all engaged in the customary routine. Nan dropped off her pajamas and walked about the room talking to one child then another. Realizing that she was slower than the others in dressing, she hurried over to her clothes which hung on hooks next to the open door leading into the hall. One of the teachers of the younger group stopped at the door to say something to the teacher in charge. Nan became much agitated, grasped her clothes about her and cried out, "Go out, go on out, don't you see I'm naked?" The teacher, who was in a hurry, passed on, apparently not aware of the flurry she

has caused. Nan proceeded with her dressing without further comment. Her behavior appeared to be more a matter of imitation than a symptom of shame. However, this incident is one of many which illustrated how the children of this group were conditioned to conventional behavior through prevailing social attitudes and practices at home without being aware of the meaning of such customs.

The following behavior suggested an incipient sadistic trend, or a satisfaction of a disagreeable emotion through the contemplated infliction of bodily pain. Julia had created so much disturbance in the sleeping room that Miss Marsh required her to sleep apart from the others. The child retained a grudge against Miss Marsh during the subsequent dressing period when she related in detail all the things she expected to do to Miss Marsh. "I'll beat her *here* (anus), and *here* (abdomen), all naked." The other children took up the theme and vied with each other in the tortures to be meted out on the body of the poor teacher. The attention of the group was diverted to other interests, but Julia's thoughts evidently reverted from time to time to her original grudge, for she repeatedly uttered threats of the punishment to be imposed on the naked body of Miss Marsh.

Two occasions were observed in which two children of opposite sex appeared to show special sex interest in each other. One of these was as follows:

When the observer entered the dressing room most of the children were grouped about the teacher who was talking with them, and the others

were engaged in dressing. Sue stood in the middle of the room, abdomen protruding. George stood opposite with abdomen out and penis erected. Both children were looking intently at each other. Sue's interest was diverted by the entrance of the observer. She left George, came to the observer and started a conversation with no evidence of self-consciousness or shame. George followed, clutching nervously at his genitals. The observer presented a negative attitude to Sue who turned away and joined the group around the teacher with her back to George who followed her persistently. His abdomen was still extended, he held his penis with both hands, with which he touched Sue's buttocks. Sue turned around, looked at him impatiently and showed no interest. "Bring your 'tee-tee,'" he said, to which Sue replied, frowning, "No, no!" Apparently she was interested in the conversation of the group, and was annoyed by his interruptions. He left, still holding and pulling at his penis. He turned to another girl and said, "Look!" At this point Miss Marsh called his attention to his dressing. The child was exceedingly unstable during the entire period. He interfered with others, dawdled, and when not occupied, manipulated his penis. He did not comply with Miss Marsh's suggestions and remained undressed at the close of the observation period.

An occasion of sex interest was observed by one of the teachers during the noon meal. This was a surreptitious examination of the genitals by a girl and a boy, both fully dressed; this, despite the fact that they customarily undressed completely in the same

room, and played around together for fifteen minutes or longer before or after the sleep period. It is apparent that some special interest may become associated with the genitals at an early age which has nothing whatever to do with curiosity about their physical appearance.

The game of taking the temperature through the rectum was acquired from the children of the younger group. There was a distinct difference in the attitude toward this play from that which was observed among the younger children. Apparently the play involved a set taboo, for it was never done openly, but always in secluded places and ceased as soon as the children became aware of the presence of an adult. The interest did not fade out as it had among the younger children. The reaction of these children to this game is significant. As a game it was too stupid to satisfy even the younger children after the element of taboo was removed. To the more mature children the fascination must have been due to a more fixed and mysterious taboo.

In general, it is obvious that the children of this group had developed a much more definite awareness of their bodies than the younger children, although with one exception, they gave no evidence of an attitude of impropriety in appearing undressed before anyone at any time. Occasions of sex play between children of opposite sex were very infrequent, yet the fact that they occurred at all is noteworthy. It is apparent that the satisfaction of curiosity alone does not necessarily prevent these incidents.

Sex differentiation. In the classifica-

tion of sex differentiation was included all incidents in which the children showed an interest in the characteristics which distinguish the sexes, either through their behavior or language. Among the younger group of children there appeared very little evidence of any recognition of such differences. Probably the differences between boys and girls were no more conspicuous to them than individual differences among girls or among boys. This was indicated by the use of the phrase "bad boy," which was applied as a term of opprobrium indiscriminately to both sexes.

Among the children of group 2 there was no misapplication of the words boy and girl. They manifested their consciousness of sex difference chiefly by differences in clothing and customs. As shown previously, some children recognized a physical difference. However, the male organ was not taken generally as one of the essential distinguishing characteristics, but as an incidental possession which girls did not happen to have. One child, Lucy, appeared to have sensed the fundamental anatomical facts of difference. The following conversation occurred between Lucy and Grace:

Lucy, "You're not a boy."

Grace, "Yes, I am."

Lucy, "No, you're *not* a boy."

Grace, "At *home* I am."

Lucy, "No, you can't be, *ever*."

Grace, insistently, "Yes, I am too, at *home*."

Lucy, "How *can* you be a boy?"

Grace, triumphantly, "'Cause I wear boys' clothes!"

Lucy, puzzled, "That's a funny way." Lucy appeared dissatisfied

with the explanation, and obviously would have protested further, but the attention of both children was diverted. On investigating the subject with the mothers it was found that Lucy had received very definite sex education from the time of her first questions in which the essentials of sex differences had been made clear, apparently. Grace's sex education had been vague. She admired greatly boyish achievements and at home always dressed in boys' clothes.

Such remarks as, "Merle's a name for a girl." "Boys wear ties, and girls do not." "Boys have short hair," were commonly heard.

One child, evidently, had received some information about nipples being a characteristic of the female as indicated in the following incident:

Babs had drawn a profile picture of a dog, standing on its hind legs. She pointed to a row of large dots which she had placed conspicuously, and said, "Those are its buttons." Miss Blair asked, "Oh, he has on a coat?" And Babs replied, "No, he is a *girl* dog." She had used the word buttons to signify nipples.

Among the younger group unconcealed attempts were observed for the girls to imitate the boys' method of urinating. No such attempts were noticed among the girls of group 2 during the observation periods. One incident was reported, however, at another period. Three girls who thought they were not observed were discussing the subject. The oldest pretended, but another child actually attempted to use the the toilet standing up in front of it. Naturally she wet her clothing which necessitated

the aid of the teacher and general embarrassment resulted among the group. On another occasion one of these girls was noticed strutting around the playground with a hose between her legs "showing off" before the other children. The emotional tone that accompanied these incidents was quite different from that of the younger girls who tried to imitate the boys.

Tabooed language. Recording was made of all language which the children used which manifested tabooed attitudes. The following behavior characteristics were considered evidence of such attitudes:

1. The child "snickers."
2. The child attempts to conceal his language or behavior.
3. Behavior ceases when an adult appears.
4. Child characterizes the language as "bad words."

Among the younger children there was only one instance in which a child showed any such evidence. This was the incident previously related in which a child whispered to the teacher his need for having a "B. M."

The use of tabooed language or "sensitized" words had appeared unmistakably among children of group 2. The language usually referred to elimination in some form and was characterized by the children as "bad words." Eight incidents were recorded during the 21 observation periods and each incident involved 2 or more children. When the incidents were noticed by the teacher she ignored them. If they did not cease naturally she diverted the children's attention to other interests. No comment was

ever made about the language. The following incident was typical:

Mack sat on the floor putting on his pajamas in a dreamy, dawdling manner. Suddenly he said out loud to no one in particular, "Hello, B. M.!" "Hello, B. M.!" He repeated the phrase with increasing animation, got up from the floor, crossed the room and approached Bert who was undressing. They whispered and giggled together and Mack admonished, "Don't you tell!" Bert then burst forth, "Hello, big pee-pee! Hello, big pee-pee!" Mack whispered again to Bert, laughed, protruded his abdomen and penis saying, "ss-ss-ss." The incident was dropped suddenly by an interest in another child's activity. Mack put on his pajamas and left the room. Bert continued to undress, absently talking to himself, "Mack, B. M. — B. M. — Mack." Then he quickly turned to Margy who stood about three feet distant: "Hello, Mrs. B. M." and laughed. Margy repeated, "B. M., B. M." and giggled. Immediately the others in the group repeated the expression like a refrain until diverted by Miss Marsh.

Another incident started a whole train of snickers, giggles and "don't tells." Janet had left the dressing room and Edna asked: "Where did Janet go?"

Miss Marsh replied, "She went to the toilet. She will be back in a moment."

After this commonplace comment Edna put her hand over her mouth, shook her head, and said, "Miss Marsh said a bad word, a bad, *bad* word."

"What did she say?" asked Anne.

"Come here and I will tell you." And there followed much suppressed whispering. The bad word it was found was toilet and was sufficient to start some sort of tabooed associations in the thoughts of this child who passed them along to the others.

Terms used for elimination and the genitals. Among the younger children a variety of family or baby terms was used openly and without self-consciousness for urination. The penis also was referred to by the use of baby terms. "B. M." was used four times for evacuation.

In the older group the children were entirely self-sufficient in the matter of elimination so that no use of any terminology seemed necessary. Penis was used twice, anus once, and breasts twice. These terms were used in the course of ordinary conversation and without emotional significance.

It was found that some of the parents had taught their children accurate terms for elimination and the genitals. However, they stated that baby terms were soon acquired from the other children and used in preference.

Behavior of teachers. All incidents of a sex nature were ignored purposely by the teachers unless the behavior was prolonged, in which case the attention of the children was diverted to other interests in a way which seemed natural and called no attention to the particular behavior. The conditioning was passive or negative in the sense that the behavior of the children called forth no overt opposition or rebuke. With respect to the language used by the children the behavior of the teachers was likewise negative.

All "sensitized" or tabooed words were ignored. Although the teachers never used baby terms for elimination they seldom used specific or accurate terms. For example, a child was told to go to the toilet when he was expected to urinate. The abbreviation, "B. M." was always used in place of the full words. However, the manner and tone of voice used by the teachers were always matter-of-fact, or like those employed towards other activities of the children. Likewise, the teachers did not use baby terms for the organs of elimination or the genitals. However, no instance was observed at any time of any teacher ever mentioning the genitals by name in the presence of the children. This statement covers not only the periods of observation during this particular study but also includes a period of two years contact with the nursery school. The children were told "to clean themselves off" after evacuation, or to "dry themselves" after urinating. On the other hand, teachers were careful to state specifically when other parts of the body were concerned, "Wash your hands," or "Dry your face."

CONCLUSIONS

From the observations made in this study the following conclusions are indicated:

The predominant attitude of children under three-and-one-half years when undressed toward their own bodies and those of other children of both sexes is the same as when dressed. However, the exceptional cases were sufficient to show that simply because a child is three-and-one-half or less he

is not necessarily without emotional attitudes toward his body.

Among the children of three-and-one-half to five there was, in general, no sense of impropriety in appearing undressed, but there was a more definite awareness and interest in their bodies than in the younger group. This awareness was shown by their comments and questions about various parts of the body and by some tendencies toward exhibitionism.

Manipulation of the genitals appeared to some extent in both groups, the nature of which seemed to be an unconscious motor activity like that of a tic. No sensory satisfaction such as is characteristic of masturbation was evident except in one case. There was no effort to conceal the activity nor any manifestation of a sense of shame. The manipulation appeared most frequently during periods of inattention and emotional instability.

In general, the younger group did not differentiate between the sexes. The expression "bad boy" was applied as a term of approbrium indiscriminately to either sex.

Differences in the appearance of the genitals were observed apparently by some of the children of the younger group, but such differences did not carry a sex significance; rather, they appeared like individual differences of eye color or hair.

The children of the older group recognized anatomical differences between boys and girls. However, they did not recognize the determinative quality of such differences, but regarded them as incidental characteristics. Even in this group distinctions between boys and girls were made

primarily on the basis of differences in styles of clothing, manner of wearing the hair and the names which the children bore.

Among the younger children elimination appeared to involve no taboo. Usually, the activity stimulated no notice.

The use of "sensitized" words appeared unmistakably among the children of the older group. These words were concerned usually with elimination in some form.

Beginnings of a fixed tabooed interest in the genitals were manifested among the older group through the tendencies to conceal their use of sensitized phrases, the concealed efforts of some girls to imitate the boys in urination, and the furtive interest in the game of taking the rectal temperature.

The exceedingly infrequent cases of sex play between children of the

opposite sex which occurred were found only among the children of the older group. However, the fact that they occurred at all indicates that such play is not always motivated only by curiosity about the appearance of the genitals of the opposite sex.

The terminology used by the children for elimination and the genitals rarely included specific, scientific terms.

The behavior of the teachers on occasions of undesirable sex behavior of the children was either an ignoring of the incidents or a diverting of the children's attention to other interests. Their behavior toward elimination was matter-of-fact as in all routine procedures.

Although the teachers never employed baby terms for elimination they did not use specific terms. The genitals were not spoken of at all.

The Influence of the Environment Upon Health and Function*

MAX SEHAM AND OLE SCHEY

THAT health habits physical and mental produce marked and at times permanent disturbances in the biological fitness of the child is commonly believed but verifiable evidence to that effect either experimental or clinical is scarce in the medical and psychological literature. The literature on this subject is rich in quantity but poor in quality. It consists chiefly of "addresses," based upon half truths and clever slogans, and of medical case reports, presented as illustrations to prove a point.

The present investigation¹ was made for the purpose of finding out how school children live and what effect environmental factors have upon their physical and physiological well being.

* From the Department of Pediatrics of the University of Minnesota. This work was assisted by a research grant from the Graduate School.

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When, in 1927 this study was begun, it was hoped that it would lead to a precise and verifiable answer to the question: What effect has the environment upon the health of the individual child? Theoretically speaking a specific answer to this question should be possible. If we knew the inherent nature of man, by careful observations and by the use of reliable tests we should be able to establish and even to measure the effects such influences as sleep, food, and other health habits have on the organism. However, with the limited methods of functional diagnosis at our disposal this is practically impossible. The situation includes a large variety of causal influences including individual differences, age, mentality, temperament and other associated factors. It is for these reasons that we have especially tried in this paper to avoid the fallacy of considering association and causation as synonymous. In presenting the following data it is at no time claimed, not even in the most constant and most significant associations and relationships, that these conditions are dependent upon one another or are caused by one another.

In this article we have attempted to study by the questionnaire method: (1) The percentage incidence of health habits, (2) the relation between health

habits and functional disorders, (3) the relation between one health habit and another, (4) the percentage incidence of functional disorders and (5) the relation between one functional disorder and another.

Two hundred sixty-two children were studied. Seventy-one children were between the ages of eight to eleven years, and one hundred ninety-one between the ages of twelve to fifteen. The younger children were a mixed group of white and colored attending school in a poor district, the older children came of somewhat better-to-do parents attending Junior High Schools in two different locations.

A QUANTITATIVE ANALYSIS OF HEALTH HABITS

Sleep. The average child sleeps about ten hours a day. He occupies a room with some other member of the family, usually a brother or sister. He frequently keeps his window open, and awakens at least once during the night to go to the bathroom. According to the standard schedule 42 per cent of the children have an inadequate amount of sleep. The children who went to sleep early (according to this schedule) fell asleep quickly, in fifteen to thirty minutes, whereas those who had insufficient sleep took much longer to fall asleep, some as long as one hour. (This fact was obtained from the mother.)

The time for going to bed varied on an average about 40 minutes between the two groups of children. The range for the younger children being from seven and one-half hours to twelve hours and for the older children from seven to eleven hours.

The actual mean for the former is 10 hours and for the latter 9.3 hours. This means that the child of from eight to ten years of this particular group retires at about 9 and arises at about 7, the older child retiring close to 10 o'clock and arising at about 7 in the morning.

Dietaries. The analysis of the dietaries by means of the questionnaire reveals not the quantity but merely what kind of food a child eats. In general one may say that the average diet of these children is one sided in quality depending upon the racial customs and habits. The diet of the Jewish child is characterized by an excessive amount of fat, improperly cooked vegetables, spicy foods such as smoked corned beef and tongue, herring, smoked fish and sardines. The Italian child eats a highly spiced diet with over emphasis upon the carbohydrates. The colored child is notoriously irregular in his food habits, going on eating sprees between meals and late at night. The dietary of the native American child is more properly balanced although deficient in the variety of vegetables.

Perhaps the following general criticism may be made of the diets as reported by the children, (1) One sided and monotonous, (2) vegetables, insufficient in amount and variety, (3) too many condiments and spurious foods.

Quantitative studies were made of the amount of candy, coffee, and milk consumed.

Candy. There is apparently very little difference in the average amount of candy eaten between the younger and the older children, the average

being 2.6 and 2 pieces respectively. Except for 10 per cent of the older children candy is eaten regularly every day by all of them.

Coffee. About one half of the younger children drink coffee daily, the average of the total group being one half of a cup a day, slightly higher for the older children (.67 of a cup). Fifty-eight per cent of the older children drink no coffee at all.

Milk. The younger children drink on an average more milk than the older, 3 against to 2.4 cups. Forty per cent of the younger and 25 per

the ages of eight and eleven play as much as the boys of the same age, but the older girls play less than their male contemporaries. The average indoor play of the younger child is 1 hour and 44 minutes and that of the older child is 1 hour and 10 minutes.

Home study. The girls average more home study than the boys at all ages.

Musical instruments. Eighty per cent of the younger and 67 per cent of the older children receive no musical instructions nor own a musical instrument. The remaining 20 per cent and 33 per cent respectively spend between

TABLE 1
A quantitative study of the health habits of 65 younger and 191 older children

	SLEEP		CANDY		COFFEE		MILK		PLAY		HOME STUDY		CLUBS		MUSICAL INSTRUMENTS		MOVIES		RADIO		PARTIES		CHORES				
	Number of hours		Number of pieces		Number of cups		Number of glasses		Number of minutes		Number of minutes		Number of minutes per week		Daily practice		Times per week		Minutes per day		Number of minutes per month		Number of minutes				
		Av.	Min.	Av.	Min.	Av.	Min.	Av.	Min.	Av.	Min.	Av.	Min.	Av.	Min.	Av.	Min.	Av.	Min.	Av.	Min.	Av.	Min.	Av.	Min.		
Younger*	10	7.5	12.2	6.0	6.5	0	3.3	0	5.1	1.0	0.24	104	0.24	59	0.135	1.1	0	4.17	0.180	1.3	0	3.45	0.240	6.0	0	4.30	0.90
Older..	9.37	11.2	11.2	0.10	67.0	0	52.4	0	8.168	0.240	70	0.240	46	0.240	.6	0	7.18	0.120	1.2	0	7.70	0.300	.6	0	4.44	0.210	

* Younger = 8-11 years; older = 12-16 years.

cent of the older drink daily one quart or more, 87 per cent and 70 per cent respectively drink one pint or more. Five per cent of the former and 11 per cent of the latter do not drink milk.

Play. A quantitative study of play is somewhat difficult to make. Notwithstanding the fact that the answers bearing on this subject gave a low similarity score, the general information obtained may be of value. The average amount of play after school is 2 hours and 31 minutes for the younger and 2 hours and 48 minutes for the older children. The girls between

seventeen and eighteen minutes in daily practice. The maximum time spent by both groups is practically the same.

Social activity. The average attendance of evening performances at motion picture theatres is about the same in both groups—usually one evening a week. However, the maximum number of visits is much higher for the older than the younger child, 7 times as compared to 3 times a week. Sixteen per cent of the former and 50 per cent of the latter never attend movies in the evening. The radio has

substituted somewhat for the movie in entertainment. The younger children spend on an average 45 minutes a day listening to the radio whereas the older children average about 70 minutes. Forty per cent of the former do not listen to the radio at all against 27 per cent of the latter. Apparently going to parties does not play very much of a rôle in the child's life. The average number of evening parties for all children is about the same, less than one party a month.

Clubs. The data collected show that the younger children spend more

functional disorders. Just how much lack of sleep and over how long a period is required to produce such symptoms has never been studied. Neither do we know whether sleep alone or sleep in association with other inadequacies of living are necessary to produce such disorders. As a standard for adequate sleep the Seham schedule given in table 3, was used. Any sleeping schedule thirty minutes or more below that standard was considered inadequate. Moreover in scoring the function of sleep we considered the quality of sleep and the psychologi-

TABLE 2

A comparison of the percentage incidence of health habits in younger and older children

AGE	SEX	NUMBER OF CASES	ADQUATE SCHEDULE	INADEQUATE SLEEP	INADEQUATE FOOD	EXCESSIVE PLAY	EXCESSIVE HOME STUDY	EXCESSIVE SOCIAL ACTIVITY	WORK FOR PAY
years 8-11	M.	34	12	42	67	39	9	8	4
	F.	30							
12-15	M.	109	18	35	43	12	11	14	31
	F.	89							
8-15		262	17	33	50	19	10	12	25

time than the older attending club meetings. This may be due to the fact that the former live in a district where social settlements are many and where children are wont to spend a great deal of their time.

Chores. The younger children average 30 minutes per day for various chores around the house, and the older 44 minutes.

The relationship between health habits and functional disorders

The factor of sleep. It is commonly believed that lack of sleep will cause

functional disorders. Just how much lack of sleep and over how long a period is required to produce such symptoms has never been studied. Neither do we know whether sleep alone or sleep in association with other inadequacies of living are necessary to produce such disorders. As a standard for adequate sleep the Seham schedule given in table 3, was used. Any sleeping schedule thirty minutes or more below that standard was considered inadequate. Moreover in scoring the function of sleep we considered the quality of sleep and the psychologi-

cal background at the time the child went to bed, as well as the quantity of sleep. These items of course are impossible to measure. The average number of hours for each age as revealed by the questionnaire is given in the last line marked with an asterisk. It is apparently lower than the schedule used as a standard. Table 4 throws some light on the relationship between sleep on the one hand and functional disorders on the other. As can be seen there is an association between adequate sleep and good general health.

TABLE 3

Average number of hours of sleep by age groups as advised by various writers

	AGE									
	5 to 6	7	8	9	10	11	12	13	14	15
Terman.....	11.14	10.41	10.42	10.13	9.56	10.00	9.36	9.31	9.06	8.54
Ravenhill:										
Boys.....	10.30	10.30	9.30	9.15	9.15	8.45	8.15	8.30		
Girls.....	10.45	10.30	10.15	9.30	9.30	9.15	8.00	7.30		
Duke.....	13.50	13.00	12.50	12.00	11.50	11.00	10.50	10.00	10.00	9.50
Bernhard.....		11.00	11.00	11.00	10.50	10.50	10.00	10.00	10.00	9.50
Hertel.....	11.00	10.50	10.50	10.00	10.00	9.75	9.50	9.50	9.00	9.00
Claparede.....	11.50	11.50	11.50	10.50	10.50	9.50	9.50	9.50	9.00	9.00
Manaceine.....	14.00	11.00	11.00	11.00	10.00	10.00	9.50	8.50	8.50	8.00
Krollich.....	11.00	11.00	11.00	11.00	10.50	10.50	10.00	10.00	9.50	9.00
Cavanagh.....			12.00							
Brown.....	11.50						10.00			
Pfaunder.....	11.00						9.00			
Key.....	11.00						10.00			
Seham.....		12.00	12.00	11.50	11.00	11.00	10.50	10.00	9.50	9.50
Seham.....			10.00	10.00	10.00		9.7	8.9	9.00	9.00

TABLE 4

The relationship between sleep on the one hand and functional disorders on the other

	HEALTH				FATIGUE				NERVOUSNESS			
	Good		Poor		Present		Absent		Present		Absent	
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Adequate sleep.....	141	87	21	13	48	30	110	70	53	33	108	67
Inadequate sleep.....	27	28	71	72	52	52	48	48	46	47	51	53
D.....	59 ± 04				22 ± 04				14 ± 04			
D/PE _d	144.75				5.50				3.50			

TABLE 5

The relationship between the number of hours of sleep on the one hand and fatigue and nervousness on the other in 190 children between the ages of 12 to 16 years

NUMBER OF HOURS OF SLEEP	FATIGUE				NERVOUSNESS				D	D/PE _d		
	Present		Absent		Present		Absent					
	Number of cases	Per cent										
7- 9	46	50	46	50	40	42	55	58	.08 ± .05	1.60		
9-11	33	33	63	66	32	35	60	65	.02 ± .04	.50		
11+	2	0	0	100	2	0	0	100				
D.....	$17 \pm .05$				$.07 \pm .04$							
D/PE _d	3.40				1.75							

Of the children with an adequate sleep schedule, eighty-seven per cent had good health and 13 per cent poor general health. The exact opposite is true in the group with inadequate sleep. This is a significant finding. The odds against the differences being a result of pure chance are more than 2 billions to 1.

In order to determine the significance of the differences of the probable errors of the means—the following formulas were used:

$$(1) \quad PE_m = .6745 \frac{SD}{\sqrt{N}}$$

$$(2) \quad PE_{D_{m_1-m_2}} = \sqrt{PE_{m_1}^2 + PE_{m_2}^2}$$

$$(3) \quad \frac{D_{m_1-m_2}}{PE_D} = \text{Ratio}$$

A ratio of three means that the probability that the estimated difference arose purely as a result of chance is 4.3 per cent or to put it in other words—in 100 trials, a deviation of this size or greater would be expected to occur as a result of chance alone 4.3 times. If we express it in still a more practical way, we can say that the odds against the estimated ratio occurring as result of chance alone is 22.26 to 1. If the ratio is 4, the odds against such a deviation are 142.26 to 1. A difference is considered to be definitely significant if the odds are about 100 to 1 or greater. This scheme will be used throughout the rest of the paper.

There is a similar relationship though somewhat less pronounced between sleep and fatigue. Those with adequate sleep share symptoms of fatigue to the extent of 30 per cent as compared with fifty-two per cent in children who have inadequate sleep. This contrast is also shown in table 5, where we compare the quantity of sleep with the incidence of fatigue. Of the children who sleep between

seven and nine hours, 50 per cent suffer from fatigue, of those having between nine and eleven hours only 33 per cent. Furthermore children having 11 hours or more had no symptoms of fatigue. It is true that the last group are too small to use for contrast but the tendency shows a high relationship between inadequate sleep and fatigue.

A similar relationship exists between "sleep" and "nervousness" as shown in tables 4 and 5. The term nervousness is used here to designate the symptom complex which usually goes under the name of "motor restlessness," or hyperkinesis. There is a definite difference in the incidence of these symptoms and signs in children who have an adequate amount of sleep and those who have an inadequate amount. The same relationship is evident when one compares the actual hours of sleep with "nervousness."

There also seems to be a significant association between sleep on the one hand and growing pains and headaches on the other (table 6). Children with adequate sleep gave histories of having growing pains to the extent of 15 per cent while those who had insufficient sleep complained of the same discomforts to the extent of 34 per cent. Again if a comparison is made with reference to headaches it is found that twice as many children complain of headaches in the latter group (68 per cent) than in the former (32 per cent).

Home study. It is to be expected that if home study is done in the evening it is bound to interfere with the amount of sleep. The answers to the questions as to home study reveals only the amount and not, at what time,

it took place. However, there seems to be such a close relationship between adequacy of home study and adequacy of sleep that the deduction is justified that at least part of the home study was carried out in the evening (table 7).

Of children whose home study is adequate 67 per cent have adequate

Social activities. Here the relationship is not so definite. Among those whose social activities were considered adequate, 64 per cent were adequate in their sleep—and 36 per cent inadequate. Of those who were judged excessive in their social activity—45 per cent had adequate sleep

TABLE 6

The relationship between sleep on the one hand and growing pains, and headache on the other

	GROWING PAINS				HEADACHE				D	D/PE _d		
	Present		Absent		Present		Absent					
	Number of cases	Per cent										
Adequate sleep	25	15	138	85	53	32	109	67	18±.04	4.50		
Inadequate sleep	33	34	64	66	47	68	51	32	34±.04	8.50		
D	19±.04				35±.04							
D/PE _d	4.75				8.75							

TABLE 7

The relationship between home study and sleep

	SLEEP				D	D/PE _d		
	Adequate		Inadequate					
	Number of cases	Per cent	Number of cases	Per cent				
Adequate home study	155	67	76	33				
Excessive home study	7	25	21	75				
D	42±.06							
D/PE _d	7.00							

and 33 per cent inadequate sleep. On the other hand, of those children whose home study is excessive, only 25 per cent have adequate and 75 per cent have inadequate sleep. If we compare the younger with the older children practically the same figures are found as shown in table 8.

against 55 per cent with inadequate sleep (table 9).

The factor of food. The question of diets has received during the last 10 years a great deal of attention in pediatric literature. Most of the literature is concerned with experimental studies on animals, primarily in the realm of chemistry. However, the question of the influence of food on function has remained a vast uncultivated field of research. We have shown in a previous article (1) that food and behavior in rats are related to one another as cause and effect and with that as a basis we were interested to see whether there exists a similar relationship between quantity of food and function in children. This is, of course, difficult to determine by a questionnaire study, which does not permit quantitative measurements of food intake. (See questionnaire num-

TABLE 8
Relationship between home study and sleep

	SLEEP								D	D/PE _d		
	Younger				Older							
	Adequate		Inadequate		Adequate		Inadequate					
	Num- ber	Per cent	Num- ber	Per cent	Num- ber	Per cent	Num- ber	Per cent				
Adequate home study.....	33	60	22	40	122	70	54	30	10±.05	2.00		
Excessive home study.....	0	0	6	100	7	31	15	69	31±.06	5.17		
D.....					60±.05							
D/PE _d					12.00							

TABLE 9
The relationship between social activity and sleep

Number of children, 259

	SLEEP									
	Adequate		Inadequate		Adequate		Inadequate			
	Number of cases	Per cent								
Adequate social activity.....	147	64	79	36						
Excessive social activity.....	15	45	18	55						
D.....			19±06							
D/PE _d			3.17							

TABLE 10
The relationship between food on the one hand and functional disorders on the other

	GENERAL HEALTH		FATIGUE		NERVOUS- NESS	
	Poor	Good	Present	Absent	Present	Absent
	per cent	per cent	per cent	per cent	per cent	per cent
Adequate food.....	20	80	35	65	32	68
Inadequate food.....	19	81	42	58	43	57
D.....		1±.04	7±.04		11±.04	
D/PE _d25	1.75		2.75	

QUESTIONNAIRE OF "HEALTH HABITS." NO. 1

(To be answered by the Child)

Name..... Age..... School.....
Address..... Grade..... Date.....

- (1) What time do you get up in the morning? *No later than 7 o'clock.*
- (2) What time do you eat breakfast? *No later than 7 o'clock.*
- (3) How long does it take you to eat breakfast? *No less than 15 minutes.*
- (4) What do you eat for breakfast? Mention the last breakfast you ate.
 - (1) *Milk—fruit—and one other article.*
- (5) What time do you eat the noon meal?
- (6) How long does it take you to eat the noon meal? *No less than 20 minutes.*
- (7) Do you eat the noon meal at home or at school?
- (8) What do you eat for the noon meal? Mention the last noon meal you ate.
 - (1) *Milk—at least 1 vegetable—one other article.*
- (9) What time do you eat supper? *No later than 7 o'clock.*
- (10) How long does it take you to eat supper? *No less than 30 minutes.*

(11) What do you eat for supper? Mention the last supper you ate.
 (1) *Meat—vegetables, dessert, milk.*

(12) What vegetables do you eat? Mention each separately.
 (1). (2). (3). (4). *At least 4 vegetables.*
 (5). (6). (7).

(13) How many pieces of candy do you eat a day? *No more than 3.*
 (14) At what time of day do you eat candy? *Not between meals.*
 (15) How many cups of coffee do you drink daily? *Not more than 1 cup.*
 (16) How many glasses of milk do you drink daily? *No less than 3.*
 (17) How often do you use medicines for your bowels? *Not more than once a month.*

* (18) How often do you take a rest or nap in the daytime?
 (19) How many hours a day do you play out of doors? *No less than 1, no more than 3.*
 (20) How many hours do you play indoors? *No more than 1 hour.*
 (21) How many hours do you spend in home study? *Depends upon age (see schedule).*
 (22) When do you do your home study? *Preferably in the afternoon.*
 (23) How many clubs do you belong to? *No more than one.*
 (24) How many times a week do you meet with your club? *No more than once.*
 (25) What time of day do you meet with your club? *Preferably afternoon.*
 (26) How much time do you practice on your musical instrument? *No more than 1 hour a day.*
 (27) At what time of day do you practice on your instrument? *Preferably afternoon.*
 (28) What days of the week do you go to the movies? *Only weekends (once).*
 (29) What time of day do you go to the movies? *Only afternoons.*

* (30) How often do you listen to the radio?
 (31) What time of day do you listen to the radio? *Not later than scheduled bed-time.*
 * (32) How far do you live from school?
 * (33) Do you walk to and from school?
 * (34) What work do you do at home for your mother?
 (35) How long does it take you to do this work? *Not more than 1 hour daily.*
 (36) What time of the day do you do this work? *Not before school or in the morning.*

* (37) What do you do after supper?
 (38) What do you do before breakfast? *No work should be done.*
 (39) What work do you do for pay? *No outside work.*

* (40) How long does this work take you?
 (41) How much do you earn a week? *No work for pay outside home.*
 (42) How many parties in the evening do you go to in a month? *No more than 2 a month.*
 (43) What time of the week do you go to parties? *Only weekends.*
 (44) How late do you stay at the party? *No later than scheduled time for sleep.*
 (45) How many books do you read a week?
 (46) Do you sleep with your window open? *Window should be opened.*
 (47) Does anybody sleep in the same bed with you? *Should sleep alone.*
 (48) How many sleep in the same room with you? *Should sleep alone in room.*
 (49) What time do you go to bed? *See schedule.*
 (50) How long does it take you to fall asleep? *No more than 30 minutes.*

ber 1, questions 2 to 17). There is practically the same relation between adequate food and general health as between sleep and general health—but for an unexplainable reason, there seems to be a larger amount of good

general health than poor among the children with inadequate diet.

Fatigue occurs more frequently among the children with inadequate food. In the former there is 42 per cent showing fatigue; in the latter 35

per cent. The same is true of the incidence of nervousness. The causal relation between habits of living and functional disorders stands out even more strikingly if one relates food and sleep with functional disorders. Since the factor of safety is sufficiently

large and the muscle tone good. Group B were of average weight, with or without some slight defect which did not handicap the child functionally. Group C were 10 per cent or more below weight, malnourished, and definitely below par physically.

TABLE 11

The relationship between food and sleep on the one hand and functional disorders on the other

	GENERAL HEALTH				FATIGUE				NERVOUSNESS			
	Present		Absent		Present		Absent		Present		Absent	
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Inadequate food and sleep.....	32	16	177	84	49	36	86	64	73	34	137	66
Adequate food and sleep.....	17	34	34	66	54	43	71	57	28	56	22	44
D.....	$18 \pm .05$				$7 \pm .04$				$22 \pm .05$			
D/PE _d	3.60				1.75				4.40			

large to enable the body as a whole to prevent or at least to postpone a physiologic breakdown though the strain on one organ or system may be constant one would hardly expect that one habit of living would produce abnormal changes in function. It is therefore surprising to find such a strong relation between inadequate sleep and food, either alone or in combination and functional disorders.

Physical status and health habits. To study the relationship between the physical status of the child and his health habits each child was examined carefully according to a standard form. On the basis of the findings the children were divided into 3 groups. In Group A were those physically superior, either normal or above in weight, a healthy appearance of skin and of color, no ascertainable physical defects, good posture, muscles were

TABLE 12
Relationship between physical status and health habits

PHYSICAL STATUS	PERCENTAGE OF INCIDENCE							
	Adequate schedule	Inadequate sleep	Inadequate food	Excessive play	Excessive home study	Excessive social activity	Work for pay	
A	11	29	26	13	8	8	5	5
B	8	29	28	20	5	5	4	
C	11	22	31	14	8	6	8	

Of course these are arbitrary classifications and therefore have their limitations of accuracy. There are however no better clinical methods of grouping children as to their physical status. In table 12 it can be seen that there is hardly any difference in the incidence of inadequate health habits in the three groups. Group C have somewhat less sleep than Group A.

The only suggestive difference is in regard to outside work for pay. About twice as many of the children in group C work for pay as in Groups A and B. To draw from these findings the inference that health habits do not

The incidence of functional disorders. The incidence of functional disorders was also computed by means of the questionnaire, number 2 (table 13). A larger number of children of the younger group are entirely free from

TABLE 13
The percentage incidence of functional disorders in younger and older children

AGE years	SEX	NUMBER OF CASES	NO FUNCTIONAL DISORDERS	POOR GENERAL HEALTH	SOCIAL MALADJUSTMENT	SCHOOL INEFFICIENCY	HEADACHES	GROWING PAINS	SEAT AND DESK MALADJUSTMENT	DEPICTIVE VISION	DEFECTIVE HEARING	FATIGUE	IDIOSYNCRASY TO FOOD	NERVOUSNESS	CIRCULATORY SYMPTOMS
8-11	M.	34	22	22	38	23	45	31	12	28	0.4	31	30	39	0.9
	F.	30													
12-15	M.	109	14	17	35	32	36	19	11	12	0.1	40	38	38	11
	F.	89													
8-15		262	16	18	36	30	40	21	11	16	2	40	36	40	11

TABLE 14
The relationship between school efficiency on the one hand and fatigue and nervousness on the other

Number of children, 260

	FATIGUE				NERVOUSNESS				D	D/PE _d		
	Present		Absent		Present		Absent					
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent				
Adequate school efficiency	54	31	117	69	56	31	121	69	0.±.03	0		
Inadequate school efficiency	56	63	32	37	44	53	39	47	10.±.06	1.67		
D.....	32±.04				22±.04							
D/PE _d	8.00				5.50							

effect the physical health status, is hardly justified. It would be safer to suggest that the effect of inadequate health habits is better studied on the individual child by comparing his habits of living with physical growth and development over a long period of time.

functional disorders than the older only 16 per cent of all children are entirely free from pathologic physiology. Generally speaking the younger children are inferior to the older with respect to general health, and social efficiency. They are superior to the older children in school efficiency, they

show a higher percentage of headaches, and of growing pains. Their complaints of maladjustment to seats and desks are about the same. The incidence of defective vision and defective hearing is higher. They do not complain quite so much of fatigue symptoms nor of idiosyncrasies to food. The amount of nervousness is about the same. There is a marked difference in favor of the younger group with respect to such circulatory disorders as dyspnoea, dizziness, fainting, and palpitation.

TABLE 15
The relationship between scholarship and school efficiency

NUMBER OF CASES	SCHOOL EFFICIENCY			
	Good		Poor	
	Number of cases	Per cent	Number of cases	Per cent
B	49	42	89	7
C	108	85	80	23
D	57	26	45	31
				55

The relationship between one functional disorder and another. Fatigue. There is a clinical point of difference between subjective fatigue which is expressed in the child's complaints of being tired, and objective fatigue which is an actual decrease in the child's ability and capacity for work. There is no recognized diagnostic method to determine the presence of objective fatigue, unless one uses scholarship as determined by the teacher as a criterion of mental efficiency. Good "scholarship" might indicate absence of mental fatigue, while poor "scholarship" might suggest mental fatigue. The school work was

judged in 2 ways, first by the "school efficiency" represented by the answers of the child to questions 12 to 20 in questionnaire number 2 and the "scholarship" represented by the average marks for the two months preceding the questionnaire study. That there exists a close relationship between "school efficiency" (subjective) as judged by the child and "scholarship" (objective) as marked by the teacher is well brought out in table 15. For the purpose of computation "scholarship" was listed in 3 groups.

TABLE 16
The relationship between scholarship and fatigue

NUMBER OF CASES	FATIGUE			
	Present		Absent	
	Number of cases	Per cent	Number of cases	Per cent
A and B	47	16	34	31
C	108	38	35	70
D	59	30	51	29
				49

Groups A and B (excellent) group C (average) and group D (poor). Of the children in A and B "school efficiency" was good in 89 per cent and poor in 11 per cent. In group C it was good in 80 per cent and poor in 20 per cent. In group D, however, there were 45 per cent with good and 55 per cent with poor efficiency. These findings would make permissible the use of "school efficiency" as an index of mental fatigue. If then school efficiency may be taken as a criterion of mental efficiency it may be said that among the group of children whose school work was adequate (A-B-C), only 31 per cent complained of symp-

toms of fatigue (table 16) whereas those whose school work was inadequate showed 51 per cent fatigue, quite a significant difference. Almost the same figures hold in regard to "nervousness," as shown in table 17. The significance of the differences between school efficiency on the one hand and fatigue and nervousness on the other is well shown in table 14. That the relationship between school efficiency and fatigue is high and positive, is more than a billion to one against its being a pure chance, and

predispose or make more likely the occurrence of circulatory signs and symptoms.

Fatigue and headaches. We are prone to explain headaches upon a physical or an infective basis, and to accept the same causes in the child that are supposed to obtain in the adult. Apparently the literature on the subject does not consider headaches as due to inadequacy of health habits. There is no question that some children have headaches because of unusual excitement, emotional over-

TABLE 17

The relationship between scholarship and nervousness

NUM- BER OF CASES	NERVOUSNESS			
	Present		Absent	
	Num- ber of cases	Per cent	Num- ber of cases	Per cent
A and B	49	15	30	70
C	110	42	38	62
D	58	28	48	52

19,000 to 1 in the case of school efficiency and nervousness. It can be said then that "scholarship" and "school efficiency" as these terms are used here are indices of a similar although not synonymous function and that subjective fatigue has a significant relationship to mental fatigue. Where fatigue is present circulatory symptoms are present in 23 per cent whereas among the children in whom fatigue is absent these symptoms are present in 4 per cent (table 18). In other words in a state of fatigue the incidence of circulatory symptoms is six times as high as when it is absent. This suggests the possibility that fatigue may

TABLE 18

The relationship between fatigue and circulatory symptoms

	CIRCULATORY SYMPTOMS			
	Absent		Present	
	Number of cases	Per cent	Number of cases	Per cent
Fatigue absent.....	151	96	6	4
Fatigue present.....	80	77	23	23
D.....			19 ± .03	
D/PE _d			6.33	

strain, lack of sleep and excessive play.

Among the children in whom fatigue was present, headache was associated to the extent of 49 per cent whereas in those in whom there was no complaint of fatigue, headache was present in only 32 per cent (table 19).

Fatigue and growing pains. Physicians usually look upon "growing pains" as rheumatic in nature. When fatigue is present growing pains are present in 38 per cent and where it is absent this disorder is present in only

about one-fourth as many or 10 per cent of cases (table 20).

Fatigue and nervousness. Table 21 shows the relationship between the two most common disorders namely, subjective fatigue and "nervousness."

If fatigue is not present nervousness is present in 28 per cent. In other words among the children who complain of subjective fatigue, the incidence of "nervousness" is twice as high as among normal children. The fact

TABLE 19
The relationship between fatigue and headache

	HEADACHE			
	Absent		Present	
	Number of cases	Per cent	Number of cases	Per cent
Fatigue absent.....	109	68	49	32
Fatigue present.....	52	51	50	49
D.....		17±.04		
D/PE _d		4.25		

TABLE 20
The relationship between fatigue and growing pains

	GROWING PAINS			
	Present		Absent	
	Number of cases	Per cent	Number of cases	Per cent
Fatigue present.....	40	38	64	62
Fatigue absent.....	16	10	140	90
D.....		28±.04		
D/PE _d		7.00		

(See questions 52 to 63 in questionnaire No. 2.) These two conditions appear together in 23 per cent, a higher association than in any two functional disorders. Alone they appear in about the same frequency. If fatigue is present "nervousness" also is present in 60 per cent of the cases.

TABLE 21
The relationship between fatigue and nervousness in 280 children from eight to fifteen years

	NERVOUSNESS			
	Absent		Present	
	Number of cases	Per cent	Number of cases	Per cent
Fatigue absent.....	115	72	43	28
Fatigue present.....	41	40	61	60
D.....		32±.04		
D/PE _d		8.00		

TABLE 22
The relationship between working for pay and fatigue

	FATIGUE			
	Absent		Present	
	Number of cases	Per cent	Number of cases	Per cent
Not working for pay....	128	77	68	33
Working for pay.....	29	46	35	54
D.....		31±.04		
D/PE _d		7.75		

that they are present in the same child at the same time to the extent of 60 per cent is certainly more than mere coincidence.

Fatigue and work for pay. Do fatigue and work for pay frequently appear at the same time? The answer to this question (table 22) is decidedly

QUESTIONNAIRE OF "EFFICIENCY." NO. II

(To be answered by the Child)

Name.....Age.....School.....

Address.....Grade.....Date.....

- (1) Do you always feel strong and well? *Yes.*
- (2) Why don't you feel strong and well? *I always do.*
- (3) Are your feelings ever hurt so badly that you cry? *No.*
- (4) What hurts your feelings so that you cry? *Nothing.*
- (5) Do you often get cross over little things? *No.*
- *(6) What makes you cross?
- (7) Do you giggle a great deal and find that you cannot help it? *No.*
- (8) Do you think that you are easily excited? *No.*
- *(9) What excites you easily?
- (10) Do you make friends easily? *Yes.*
- (11) Do you keep your friends long? *Yes.*
- (12) Do you find school a hard place to get along in? *No.*
- (13) Are you anxious to get away from school? *No.*
- (14) Why are you anxious to get away from school? *I am not.*
- (15) Do you like your teachers? *Yes.*
- (16) Is it hard for you to pay attention to the work in school? *No.*
- (17) Is it hard for you to learn? *No.*
- (18) Is it hard for you to remember things? *No.*
- (19) Do you finish what you start out to do? *Yes.*
- (20) Why don't you finish what you start out to do? *I do.*
- (21) How often do you have headaches? *Never (once a month).*
- (22) Do you ever have headaches? *No.*
- *(23) How many minutes or hours does your headache last?
- *(24) At what time of the day does your headache come on?
- (25) Do you get a headache after reading? *No.*
- (26) Do you get a headache after play? *No.*
- (27) Do you ever have backaches? *No.*
- (28) How often do you have a backache? *Never (once a month).*
- (29) When does your backache come on? *Never have them.*
- (30) Do you ever have pains in your arms? *No.*
- (31) How often do you have pain in your arms? *Never (once a month).*
- *(32) When does the pain in your arms come on? *Never have them.*
- (33) Do you ever have pain in your legs? *No.*
- (34) How often do you have a pain in your legs? *Never.*
- *(35) When does the pain in your legs come on? *Never have them.*
- (36) Do any of your muscles ache when you are sitting at your school desk? *No.*
- (37) How often do your muscles ache when you are sitting at your school desk? *Never.*
- (38) Do your desk and seat hurt you? *No.*
- *(39) When do your desk and seat hurt you? *Never.*
- (40) Is your desk too high for you? *No.*
- (41) Is your desk too low for you? *No.*
- (42) Do your feet touch the floor when you are sitting at the desk? *Yes.*
- (43) Do you feel cramped in your seat? *No.*
- (44) Can you read the writing on the blackboard from where you sit? *Yes.*
- (45) Do your eyes hurt you during reading in school? *No.*
- (46) Do you have to hold your book close to your eyes when you read? *No.*
- (47) Do you have to hold your book far from your eyes when you read? *No.*

(48) Do things ever get black before your eyes? *No.*
 *(49) When do things get black before your eyes? *Never.*
 (50) Can you hear the teacher from where you sit? *Yes.*
 (51) Can you hear the other children recite from where you sit? *Yes.*
 (52) Do you get sleepy in school? *No.*
 (53) Do you get tired in school? *No.*
 (54) When do you get tired in school? *Never.*
 (55) Do you feel tired at noon? *No.*
 (56) Do you feel tired after luncheon? *No.*
 *(57) Why do you feel tired after luncheon? *I don't.*
 *(58) Do you feel tired after school is out? *Either yes or nor.*
 *(59) Do you feel tired in the evening before going to bed? *Yes or no.*
 (60) Is it hard for you to get up in the morning? *No.*
 (61) Why is it hard for you to get up in the morning? *It is not.*
 (62) Do you feel sort of tired a great deal of the time? *No.*
 (63) Do you usually sleep well? *Yes.*
 (64) Are you hungry when you sit down at meal time? *Yes.*
 (65) Do you enjoy your meals? *Yes.*
 (66) What foods make you sick to your stomach? *None.*
 (67) How often do you get sick to your stomach? *Never.*
 (68) Can you sit still without moving around all the time? *Yes.*
 (69) Do you play with the things on your desk a great deal? *No.*
 (70) Do you bite your finger nails? *No.*
 (71) Do you bite your lips? *No.*
 (72) Do you suck your thumb? *No.*
 (73) Do you pick your nose? *No.*
 (74) Do you pick your face? *No.*
 (75) Do you put your fingers through your hair a great deal? *No.*
 (76) Do you get out of breath quickly? *No.*
 (77) When do you get out of breath? *Only after running.*
 (78) Does your heart pound so that you can hear it? *No.*
 (79) When does your heart pound so that you can hear it? *After playing.*
 (80) How often have you fainted away? *Never.* Have you ever fainted? *No.*
 (81) How old were you when you fainted away? *I never have.*
 *(82) Why did you faint away? *I didn't.*
 (83) Do you get dizzy often? *No.*
 (84) When do you get dizzy? *I don't.*

* Dummy questions.

"yes." This of course may not mean that work for pay in itself is a prime or sole cause of fatigue but one cannot ignore the factual information which this study reveals. Those who work for pay complain of fatigue to the extent of 54 per cent as compared to the others in whom fatigue was only present in 33 per cent, a difference of 21 per cent.

Fatigue and outside play. The

amount of play which a child needs and what effect excessive play has upon the behaviour of a child over a long period of time are practical questions, precise answers to which cannot be given. Table 1 shows the average amount of out-of-door play the children of different ages indulge in. We use as a maximum schedule the figures suggested in this table. With this key as a guide, we found that

there was 5 per cent more fatigue among the children whose play was considered excessive than among those whose play activity was considered adequate (table 23).

Fatigue and posture. It is commonly believed that good posture and

small number had what may be considered good posture that one is hesitant to present the figures, and therefore any clinical evaluation. The contrast between the incidence of nervousness in children with good and bad posture is quite marked, about 24 per cent more nervousness occurring in the latter than the former. The same does not hold true with respect to fatigue (table 25).

As can be seen the children with poor posture seem to suffer less from fatigue, than those with good posture. No explanation can be offered for this seemingly illogical situation. A larger number of observations may clarify this point.

Headache and defective vision. Headaches are associated with poor vision in 25 per cent of the cases and 13 per

TABLE 23
The relationship between play activity and fatigue

	FATIGUE			
	Absent		Present	
	Number of cases	Per cent	Number of cases	Per cent
Adequate play activity...	130	61	83	39
Excessive play activity...	26	56	20	44
D.....		5±.05		
D/PEd.....		1.00		

TABLE 24
A comparison of the relationship of play activity and fatigue between younger (61) and older (198) children

	FATIGUE								D	D/PEd		
	Younger				Older							
	Absent		Present		Absent		Present					
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent				
Adequate play activity.....	29	76	10	24	101	58	73	42	18±.06	3.00		
Excessive play activity.....	12	54	10	46	14	58	10	42	4±10	.4		
D.....		22±.09				0±.08						
D/PEd.....		2.44				0						

good general function of the body are closely associated. Orthopedists declare, that bad posture produces fatigue but they have not produced evidence that bad posture precedes the signs and symptoms of fatigue. Of the 36 children examined with special reference to posture such a

cent suffer from poor vision but report no headaches (table 26).

The relationship between functional disorders and physical status. It was of interest to see whether functional disorders went hand in hand with the physical status of a child. If this were so we should expect to find a

higher incidence of functional disorders among those graded B and C, than

Group A than in Group C. Their general health is better. The children

TABLE 25

The relationship between posture on the one hand and nervousness and fatigue on the other

	NERVOUSNESS (1) AND (2)				FATIGUE			
	Present		Absent		Present		Absent	
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Good posture.....	6	38	10	62	4	50	4	50
Poor posture.....	28	62	17	38	9	32	19	68
D.....			24±.09				18±.09	
D/PE _d			2.67				2.00	

TABLE 26

The relationship between headache and vision

	VISION			
	Good		Poor	
	Number of cases	Per cent	Number of cases	Per cent
Headaches absent.....	141	87	20	13
Headaches present.....	75	75	24	25
D.....		12±.04		
D/PE _d		3.00		

physically superior show a superiority in regard to school efficiency. The incidence of growing pains and defective hearing is smaller. As regards fatigue and nervousness, however, the incidence is higher in Groups A and B, than in C.

SUMMARY AND CONCLUSIONS

A. By the use of the questionnaires the reliability and validity of which may be questioned, we have tried in this paper to determine

TABLE 27
Relationship between physical status and functional disorders

PHYSICAL STATUS	PERCENTAGE OF INCIDENCE												
	No functional disorders	Poor general health	Social maladjustment	School inefficiency	Headaches	Growing pains	Seat and desk maladjustment	Defective vision	Defective hearing	Fatigue	Idiosyncrasy to food	Nervousness	Circulatory symptoms
A	10	33	12	3	12	5	5	7	0	13	8	17	5
B	3	6	11	9	13	8	6	7	0	11	10	10	5
C	8	10	11	8	12	7	3	5	3	8	8	14	3

among those graded A. There is a larger number of normal children in

(1) The percentage incidence of health habits in 262 school

children of from eight to fifteen years of age.

- (2) The relation between health habits and functional disorders.
- (3) The relation between one health habit and another.
- (4) The percentage incidence of functional disorders.
- (5) The relation between one functional disorder and another.

B. A quantitative study was made of the following health habits of school children of a mixed social and racial group, chiefly poor and of foreign stock. Namely:

- (1) Sleep.
- (2) Food.
- (3) Home study.
- (4) Social activities.
- (5) Outside play.
- (6) Work for pay.

C. A qualitative and quantitative statistical study was made of the following functional disorders:

- (1) General health.
- (2) Social maladjustment.
- (3) School efficiency.
- (4) Headaches.
- (5) Growing pains.
- (6) Seat and desk maladjustment.
- (7) Defective vision.
- (8) Defective hearing.
- (9) Fatigue.
- (10) Ideosyncracies to food.
- (11) Nervousness.
- (12) Circulatory symptoms and signs.

D. The physically inferior children do not have a larger number of inadequate health habits than the superior children, nor do they show a significantly higher incidence of functional disorders.

E. There is a strong concomitance

statistically between inadequate Health Habits and Functional Disorders.

F. Statistically there exists a strong relationship between School Efficiency (subjective) and scholarship (objective). If "School Efficiency" is used as an index of mental fatigue, then "Scholarship" and "School Efficiency" are indices of a similar, though not synonymous, function.

G. With the exception of (1) Inadequate Food and General Health and (2) Poor Posture and Fatigue—all the other associations studied between Health Habits and Functional Disorders are positive. No explanation can be offered for these two exceptions at this time.

H. Using Pearl's Table—we can group all of the relationships as follows:

I. Highly significant:

- (1) Inadequate sleep and poor general health (more than 2 billion to 1).
- (2) Inadequate sleep and fatigue (19,000 to 1).
- (3) Inadequate sleep and headaches (2 billion to 1).
- (4) Inadequate sleep and home study (400,000 to 1).
- (5) Inadequate food and sleep and nervousness (332 to 1).
- (6) School efficiency and fatigue (more than 1 billion to 1).
- (7) School efficiency and nervousness (19,000 to 1).
- (8) Fatigue and circulatory symptoms (19,000 to 1).
- (9) Fatigue and growing pains (400,000 to 1).

(10) Fatigue and headaches
(over 200 to 1).

(11) Fatigue and nervousness
(over 1 billion to 1).

(12) Fatigue and work for pay
(over 1 billion to 1).

II. Definitely significant:

(1) Inadequate sleep and
growing pains (825 to 1)

(2) Inhibition and nervous-
ness (4.63 = 520 to 1).

(3) Inadequate food and sleep
and poor general health
(65 to 1).

III. Positive tendencies (probably
not significant):

(1) Inadequate sleep and
nervousness (54 to 1).

(2) Inadequate sleep and so-
cial activities (32 to 1).

(3) Inadequate food and fa-
tigue (4 to 1).

(4) Inadequate food and nerv-
ousness (15 to 1).

(5) Inadequate food and sleep
and fatigue (4 to 1).

(6) Poor posture and nerv-
ousness (20 to 1).

(7) Headache and poor vision
(22 to 1).

IV. Not significant:

(1) Inadequate diet and poor
general health.

(2) Fatigue and outside play.

(3) Poor posture and fatigue.

I. We do not feel justified at this
time, even in the most significant
associations and relationships to con-
sider association as synonymous with
causation.

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